

Will the U.S. Marine Corps Require a Main Battle Tank in the Twenty-First Century?

MCWAR 1998

Subject Area Warfighting

**WILL THE U.S. MARINE CORPS REQUIRE
A MAIN BATTLE TANK
IN THE TWENTY-FIRST CENTURY?**

by
Lieutenant Colonel John F. Hemleben
United States Marine Corps

1 May 1998

Submitted in Partial Fulfillment
of the Requirements for the
Marine Corps War College
Marine Corps University
Marine Corps Combat Development Center
Quantico, VA 22134-5067

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE 1998		2. REPORT TYPE		3. DATES COVERED 00-00-1998 to 00-00-1998	
4. TITLE AND SUBTITLE Will the U.S. Marine Corps Require a Main Battle Tank in the Twenty-First Century?				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Marine Corps War College, Marine Corps University, Marine Corps Combat Development Command, Quantico, VA, 22134-5067				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT Approved for public release; distribution unlimited					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT Same as Report (SAR)	18. NUMBER OF PAGES 73	19a. NAME OF RESPONSIBLE PERSON
a. REPORT unclassified	b. ABSTRACT unclassified	c. THIS PAGE unclassified			

ABSTRACT

The main battle tank has revolutionized modern warfare since World War I by strengthening land forces ability to conduct violent, offensive operations. The U.S. Marine Corps has adopted the tank but has always designed its use for specific missions and tasks. Today the tank has served the Corps in a variety of ways in all three levels of warfare, strategic, operational, and tactical. A major question today is, will the Marine Corps of the 21st century require a main battle tank?

The following paper attempts to answer this question. It will determine whether the requirement exists by first defining what a tank is in terms of capabilities. It then will address the context of the future strategic environment and describe the future National Military Strategy (NMS) devised to cope with that environment. The paper will then describe how the Marine Corps will support that future NMS. Since the future will be fraught with new technologies and wide-spread weapons proliferation, the paper would not be complete without a thorough discussion of such an environment. Lastly, conclusions and recommendations are presented. The paper builds upon itself chapter by chapter, from the large strategic view all the way down to the requirement for a main battle tank.

In sum, the Marine Corps of tomorrow must retain the capabilities currently found on the main battle tank. In fact, the "tank" of the future or "future combat system" will require even more capabilities than currently found. Survivability, lethality, mobility, shock, strategic agility, the ability to deploy infantry, fire indirect weapons systems, fire precision guided projectiles, operate in an urban environment, and be multi-variant are some of those critical requirements.

The U.S. Army seems directed in two areas, the Future Scout Vehicle (FSV) and the heavier Future Combat System (ECS). Unfortunately, neither will fulfill Marine Corps

requirements. Equally unfortunate is the shrinking USMC budget top-line. The Marine Corps can ill afford an Advanced Amphibious Assault Vehicle (AAAV), a Light Armored Vehicle (LAV), and an M1A1 main battle tank and all the associated infrastructure required to support all three of these armored vehicles.

The Marine Corps must accept revolutionary change in its look at equipment development just as it has with concepts/doctrine development. It must maintain its current older systems until it can "leap-ahead." To do this the Marine Corps must refocus the AAAV program and develop its own multi-faceted future combat system which would replace the existing three armored vehicles currently in the Marine Corps inventory. By leveraging Army FSV and FCS technology, redirecting the AAAV program efforts, and during the transition period, redirect the LAV, AAAV, and tank communities to modify doctrine, equipment logistics SOPs, and deployment techniques necessary to support the Marine Corps' revolutionary move to the future, the Marine Corps can successfully affect its transformation into the 21st century.

TABLE OF CONTENTS

DISCLAIMER	ii
ABSTRACT	iii
TABLE OF CONTENTS	v

CHAPTER	PAGE
1. ROAD MAP TO THE FUTURE	1
WHAT IS A TANK?	3
OPERATIONAL SIGNIFICANCE OF THE MARINE CORPS TANK	6
2. THE FUTURE U.S. NATIONAL STRATEGIC ENVIRONMENT	9
NATIONAL GOALS AND INTERESTS	9
THE FUTURE STRATEGIC ENVIRONMENT	10
A FINAL WORD	15
3. NATIONAL STRATEGY	17
CONCLUSIONS FROM THE JOINT STRATEGIC REVIEW	17
NATIONAL MILITARY STRATEGY	18
IN CLOSING	22
4. U.S. MARINE CORPS ROLE IN THE 21ST CENTURY	24
THE CHANGING FACE OF WARFARE	25
CORE COMPETENCIES	26
GOALS AND OBJECTIVES	27
MARINE CORPS INITIATIVES	29
SOME FINAL WORDS	35
5. FUTURE WEAPON PROLIFERATION AND TECHNOLOGIES	37
GROUND WEAPONS PROLIFERATION	37
GROUND WEAPONS TECHNOLOGIES	42
6. CONCLUSIONS AND RECOMMENDATIONS	47
CONCLUSIONS: MAN AND TECHNOLOGY	48
CONCLUSIONS: FROM THE JOINT VISION AND NMS PERSPECTIVE	50
CONCLUSIONS: FROM A MARINE CORPS PERSPECTIVE	52
RECOMMENDATIONS	60
BIBLIOGRAPHY	67

CHAPTER 1

ROAD MAP TO THE FUTURE

The main battle tank first made its debut during the First World War (WWI). Since that time, it has been the cornerstone weapons platform of United States (U.S.) military ground forces. The tank took roots first in the U.S. Army but became prominent in the U.S. Marine Corps during the Second World War's (WWII) island hopping campaigns in the Pacific, where it proved indispensable against Japanese strong points and inland defenses.

Ever since its inception, the tank has revolutionized modern warfare by strengthening land forces ability to conduct violent, offensive operations. Traditionally however, the defense, rather than the offense, has always held greater advantages in war. Clausewitz recognized it, as did those who learned the lessons from WWI. Not until the introduction of the tank did offensive warfare reemerge as a stronger and more viable concept of war. The static defense finally had been broken. Once again, nations could effectively project military power on the ground to achieve national security and political objectives. From World War I, through the Persian Gulf War, to operations other than war, the U.S. has used the main battle tank to tactically, operationally, and strategically sway the tide of battles and wars.

The future of the Marine Corps main battle tank in the twenty-first century will be determined by how the U.S. national security apparatus predicts the future strategic environment and matches those predictions to its National Military Strategy (NMS). Equally important, is how the Marine Corps foresees its role within that NMS given the context of technological developments and weapons proliferation. It is the purpose of this paper to explore whether the

United States Marine Corps will need a main battle tank of the future (2010 and beyond) to satisfy its warfighting requirement within the NMS of the 21st century.

Today the entire world seems to be passing through the industrial age, entering into an information age characterized by tremendous uncertainty derived from ever increasing global dynamics. U.S. foreign policy and its NMS will be required to deal with three revolutions which have transformed the nature of global security. The *Geostrategic Revolution* whereby relations among major powers reflect asymmetrical multipolarity. The *Information Technology Revolution* where societies have become more open due to information accessibility through the wide variety of information technologies. Lastly, the *Governmental Revolution* whereby the sphere of state control is steadily shrinking and the trend toward pluralistic societies are reinforced.^[1] These emerging international developments have complicated the security environment for the U.S. In essence, the way military leaders and planners must adapt to future conflicts and challenges to our national security will require a drastic re-look at our NMS and all existing force structures, weapons technologies, and doctrinal practices to accommodate our national view of the future. As Yale Professor of History, Donald Kagan has observed:

"Since the fall of the Berlin Wall, American military forces have been used to remove the ruler of Panama, to drive the Iraqi army out of Kuwait and later to deter its return, to alleviate a famine in Somalia, to remove a military junta from Haiti and restore the elected president to power, to compel warring ethnic factions in Bosnia to stop fighting and then to enforce the resulting truce until elections could be held, and to deter a threat from China against Taiwan, among other interventions. At the same time, American forces have been stationed in Korea to deter an attack from the north and in the Persian Gulf to deter aggressive actions by either Iran or Iraq."^[2]

Dr. Kagan is not alone in his observations. It seems evident by the recent flurry in the Pentagon that the U.S. military leaders have recognized the need to change and embark upon a Revolution of Military Affairs (RMA) to meet the challenges of the 21st century. The exact

nature of this RMA and how the U.S. Marine Corps envisions its role in the future will ultimately determine the future of the Marine Corps main battle tank.

WHAT IS A TANK?

The key question is, what capabilities will the weapons systems of the 21st century require? One thing is certain, weapons have and always will be designed to disrupt, destroy, neutralize, or change enemy behavior in some manner advantageous to the user, through means that are as innovative and unique as a human's imagination. The future main battle tank will exist only in terms of its capabilities and only if those capabilities accomplish future U.S. military strategic objectives or goals.

The weapon system now called a main battle tank might even be labeled something other than "tank." The U.S. Army calls it the Future Combat System (FCS). The only similarities this future "tank" system would have with the tank of today is its capabilities and the fact these capabilities would be employed by a single weapons platform. Existence of the future tank will only occur if allowed by the fiscal constraints of today, for it is the budgets of today that determine the military capabilities of tomorrow.

For purposes of this paper, the main battle tank will be defined in terms of its existing capabilities: survivability, lethality, mobility, and shock.

Survivability: Since WWI the tank's survivability on the battlefield has relied on armor which has taken many forms, from bolted-on steel to today's composite armor. This notion of survivability is probably the tank's most significant capability when used by a democratic nation such as the U.S., which highly values the lives of its military citizens, especially when deployed to dangerous foreign shores. Tank survivability comes in two forms, vehicle survivability and individual

crewman survivability. The M1A1 Abrams tank is a good example of a tank designed for crew survivability, i.e., ammunition blowout panels, an ammunition access door, a nuclear biological chemical (NBC) over-pressure system, and a Halon fire suppression system.

Lethality: How the tank kills or disables its target has been accomplished by a plethora of means, from small caliber guns to 120 MM smooth bore cannons firing depleted uranium penetrators.

The tremendous advantage of today's tank is the number of various weapons that can be placed on a single vehicle and fired from protected locations. Tanks have become increasingly more accurate at longer ranges due to the recent developments in ordnance, optical, and digital technology.

Mobility: The tank has achieved extraordinary mobility. This has been accomplished through a varied array of tracked suspension systems. These suspension systems have been increasingly effective in traversing all types of terrain, in particular, terrain which has traditionally bogged down wheeled vehicles. Gap and vertical obstacle crossing capabilities are also unique to tracked vehicles. Even though wheels have been attached to tank-like chassises, current technology has not matched the enhanced mobility and stability tank tracks have provided.

Shock: The tank has been very successful at shocking the enemy because of its size, virtual indestructibility, lethality, and relative quickness. Shock is more than mere fear. The shock from the presence of a tank causes psychological and even physical effects upon an enemy, such as the sharp reduction of morale, a sense of deterrence, and the demonstration of a credible capacity to coerce. Having the enemy's psyche affected so drastically, can cause positive effects on friendly forces, such as a positive increase in friendly morale. Similarly, the tank's presence also demonstrates an iron will to support allies, providing a tacit yet solid commitment.

For purposes of this paper, our definition of "tank" will be limited to these four capabilities and the notion that a tank is primarily an offensive weapon. In other words, the four capabilities described above are used primarily offensively. Whether a future combat system possesses these four major capabilities plus more, does not detract from the definition, as long as the four main capabilities remain primarily offensive. One example would be a system to deploy sensors or people in the battle area, while still retaining the capabilities of survivability, lethality, mobility, and shock for offensive purposes. This type of combat system would be considered a tank, using our definition. An armored personnel carrier would not qualify as a tank under this definition even though it is an offensive weapon platform, in that it attempts to close with the enemy to deploy infantrymen using its armored gun system for suppression or defense. Its lethality is only derived from deploying other weapon systems, those of the infantrymen. Its survivability and shock effect is also limited.

Several problems have plagued the tank primarily due to its increasing weight caused by heavy suspension systems, larger engines (power packs) for increased speed, heavier ammunition, larger gun systems, and as one would imagine, heavier, thicker armor. The weight problem negatively affects fuel consumption and strategic mobility. One tank per C-5/17 does not equate to efficient use of strategic airlift. One tank per landing craft air cushion (LCAC) which causes significant lost square footage for already limited ship-to-shore mobility does not maximize expensive Naval ship-to-shore assets. Excess weight also causes difficulty in crossing existing austere bridges in many developing and underdeveloped countries.

OPERATIONAL SIGNIFICANCE OF THE MARINE CORPS TANK

It could be argued that the Marine Corps main battle tank has had significance at the operational level of warfare. Several historical examples exist for this assertion. If one is to assume the battle of Tarawa was significant for the success of future theater strategy in the northern Pacific theater during WWII, then the role of a small force of five tanks used by Marines on Tarawa which turned the tide of the battle, had operational level significance. Even though having most of their tanks destroyed in the early hours of the battle, tanks from the 2nd and 3rd Platoons of Company C, I Marine Amphibious Corps Tank Battalion, deployed with Major "Jim" Crowe, Second Battalion Eighth Marines to secure the ever important toehold which ultimately led to victory on Tarawa.^[3]

Marine tanks in Somalia which performed roadblocks, patrols, deliberate attacks on fortified positions, convoy escort, and provided for a quick reaction force enabled the U.S. Marines to successfully accomplish their humanitarian missions.^[4] The U.S. Army, who relieved the Marines, lacked organic tank units to support these same, highly "specialized" operations. To their detriment they lost several rangers to Somali clansmen. It was determined this was due to the lack of a U.S. rapid-response force equipped with tanks. Shortly after this debacle the U.S. withdrew its presence in Somalia and the Secretary of Defense resigned. Peacekeeping operations or operations other than war, such as those conducted in Somalia, possess not only operational significance, but in this case, have strategic, worldwide effects. The resolve of the U.S. as a nation and its capability to feed a starving country was challenged by low-tech and seemingly, in western perceptions, unsophisticated clansmen. Only a handful of main battle tanks could have changed the world's perception of the U.S. which was, a superpower retreating back to western hemisphere isolationism after unsuccessfully venturing out into an uncertain world like a curious

child. Instead, we could have appeared to the international community as a superpower being mature and effective in an undeveloped country accomplishing global responsibility through humanitarian efforts.

In the early months of U.S. engagement in Bosnia the Commander, Implementation Force (IFOR) in his contingency plans relied on the Marine tank platoon from the 26th Marine Expeditionary Unit (MEU) to provide a critical blocking position in a mountain pass in the vicinity of the port of Split. Without this tank platoon to block this pass, IFOR would have been required to withdraw its forces under extreme pressure if the U.S. and NATO positions had been severely challenged.^[5] One tank platoon as a key to the successful withdrawal of NATO forces from theater is a significant operational level requirement. Whether the future tank will retain such significance remains to be seen.

Throughout this paper the term "tank" will signify a single weapons platform that possesses survivability, lethality, mobility, and shock to be used primarily offensively. When attempting to examine whether the tank supports the Marine Corps' role in 2010 and beyond, it will be vitally important to remember these four capabilities and the traditional problems of today's tanks. The following chapters examine the future strategic environment (Chapter 2), the National Military Strategy and Joint Vision 2010 (Chapter 3), the Marine Corps view of the future strategic environment and its role in it (Chapter 4), technological developments and weapons proliferation (Chapter 5), and military service budgetary constraints. All conclusions and recommendations made in Chapter 6 were drawn from material in Chapters 2-5. Due to the detail and extent of these chapters, Chapter 6 will not include recaps or summaries of that previous material.

NOTES

[1] Hans Binnendijk and Patrick Clawson, eds., 1997 Strategic Assessment: Flashpoints and Force Structure. (Washington D.C.: Institute for National Strategic Studies, National Defense University, 1997), p xi.

[2] Kagan, Donald, Dr., "Are U.S. Forces Overstretched? Roles and Missions," Qrbis, Spring 1997, p. 187.

[3] Henry I. Shaw Jr., Tarawa, a legend is born (New York: Ballantine Books Inc., 1968), pp. 62-64.

[4] Personal interview with Major Michael Campbell, USMC, Commanding Officer, 1st Tank Battalion (Fwd), MARFORSOM, CJTF Somalia, 22 Oct. 1997.

[5] Personal interview with Major Keith Reimer, USMC, Planner, IFOR, 1 May 1997.

CHAPTER 2

THE FUTURE U.S. NATIONAL STRATEGIC ENVIRONMENT

Over the last year the Department of Defense (DoD) undertook an exhaustive look at the future strategic environment and how its role in that environment should be envisioned. A series of efforts has been accomplished by the Joint Staff, the individual services, and the National Defense Panel (NDP) for this very purpose. Reports from the Joint Strategic Review (JSR), the Quadrennial Defense Review (QDR), and the National Defense Panel all contain important predictions on what the future may look like in terms of national security. The National Military Strategy (NMS) and Joint Vision 2010 (JV 2010) published in 1997 are derived from all the above except for the NDP report, which was published in December 1997. An examination of these documents is critical to understanding how our NMS has been crafted for the 21st century.

NATIONAL GOALS AND INTERESTS

"America's enduring goals include: protecting the lives and safety of Americans both at home and abroad; maintaining the political freedom and national independence of the United States with its values, institutions, and territory intact; and providing for the well-being and prosperity of the nation and its people."^[1]

The preceding quote from JV 2010 is in concert with our founding fathers concept of a national goal, that being, the desire for life, liberty, and the pursuit of happiness. It truly is the purpose of this country, its government, and its protector, the military.

The world has changed dramatically in an evolving environment of globalization. (The next section will discuss this in greater detail). Our interests are framed within that changing world situation, for it is that context in which we as a nation must live and coexist with fellow nation-states. Unless the U.S. returns to its interwar years isolationism, our country must

understand the international future and adapt. The first step in adapting is establishing U.S. interests to which this nation will apply its national power and treasure. Once again JV 2010 defines U.S. interests:

"Our fundamental interests lie in enhancing U.S. security, promoting prosperity at home, and promoting democracy abroad. The United States has undertaken foreign and security policies aimed at securing these interests. Ensuring strong relations with our allies, protecting our rights of transit on the high seas, and enlarging the community of free market democracies are examples of policies we are likely to continue to pursue in the years ahead. On the whole, there is likely to be far more continuity than change in these interests and policies."^[2]

The QDR gets even more specific by adding: preventing the emergence of a hostile regional coalition or hegemon.^[3] It is from these interests the U.S. determines its national military objectives and its NMS. Next, is a discussion on the future strategic environment of 2010 and beyond to better frame U.S. NMS, JV 2010, and the Marine Corps' futuristic view.

THE FUTURE STRATEGIC ENVIRONMENT

Several areas of importance to national security include: demographics, economics, politics, technology, proliferation, military, terrorism, and international crime. These provide the context for future NMS and the way the U.S. Marine Corps looks at its future role in supporting the regional combatant commanders.

Demographics

It is projected the global population will reach seven billion (25% increase) in 2010.^[4] The developing countries will increase in population at a rate greater than developed countries. As this population increases the environment will continue to deteriorate. Declining living standards will result especially in the poorer countries of the world. Populations will migrate heavily in the

urban areas. By 2010 two-thirds of the world's population will be urbanized, with much of the growth centered in littoral areas.^[5] These factors will cause refugee migration, chronic unemployment and underemployment. Cities unable to absorb growing populations will experience acute shortfalls in services which may trigger recurrent humanitarian crises characterized by famine and disease.^[6] The median age in developed countries will increase while that age remains stable (but young) in developing countries. Religious, ethnic, and cultural groups are likely to exercise stronger influence over some populations than governments.^[7]

Economics

According to Concept for Future Joint Operations, Expanding Joint Vision 2010:

"Petroleum and natural gas should remain the most important sources of natural energy, although some nations will continue to pursue advanced nuclear power generation. The interdependence of the world economy will increase. Economic trading blocs, sometimes dominated by a single regional power, will become significant forces."^[8]

The globalization of world economies will make each nation's economy interdependent on one another. As one economy booms so may several. The converse may also be true. We are experiencing evidence of this today with the effects the South Korean and Japanese economic crises are having on the U.S. economy. Wide exchange rate fluctuations causing trade imbalances and foreign investment complications. The U.S. may discover that applying economic sanctions as a policy enforcement tool may be more difficult to implement and enforce due to the multinational character of global corporations.^[9] It is predicted that there will be increasing competition for renewable resources (i.e. water). U.S. citizens and property will be more dispersed overseas in pursuit of global business. Sustained economic growth will give some nations additional discretionary wealth.^[10] The question be, on what will these nations spend their

new found wealth? The uncontrollable transfer of information and technology most likely will continue with the globalized economies and additional wealth. Lastly, perceived disparities of wealth, where vast riches are controlled by relatively few nations, could create international tension, present political and morale challenges to governments, and ultimately lead to armed conflict.^[11]

Politics

A significant prediction is that the world will only see one superpower between now and 2015, the U.S. There is no other global peer competitor likely.^[12] What we will see is a more multi-polar environment characterized by more states with greater national power relative to the U.S.; China, Western Europe, Japan, India, Russia, Iran, Iraq, Korea, Pakistan, Brazil, South Africa, Israel, and others. What will emerge is a greater diversity of actors; states, failed states, international organizations, non-governmental organizations (NGOs), ethnic groupings, extremists, international organized crime, and multi-national corporations.^[13] These diverse actors will most likely seek to influence global security for organizational purposes. The number of developing countries that face serious instability and potential state failure due to political unrest will increase.^[14] No later than 2020 it is envisioned a reconciled if not unified Korean peninsula could exist.^[15]

Technology and Information

The diffusion of technology will continue to increase which will make significant military capability available. Intimately tied to this diffusion of technology is the access of information which will become comparatively equal among states. Superiority will be determined by the

speed and accuracy at which this information can be understood, disseminated, and acted upon by its user.^[16] Technology and its transfer will affect nation states, their militaries, as well as non-state actors, and others who may disrupt global security.

Proliferation

Even though proliferation will be discussed in more detail in Chapter 5 it suffices to say that proliferation of inexpensive, highly effective weapons will likely increase due to available technology, information, and asymmetric advantage potential.^[17] Proliferation of both conventional and weapons of mass destruction (WMD) will continue. The number of nuclear-capable states will likely expand. Even the possibility that nuclear, biological, and chemical weapons falling into the hands of non-state groups will increase. Proliferation of intercontinental ballistic missiles is unlikely, however, proliferation of theater ballistic and cruise missiles will increase the vulnerability of U.S. and allied military forces in theater and jeopardize access to ports and airfields.^[18]

Military

Military power will remain one of the primary tools for political and strategic competition between states, including major powers. Most countries will prefer to form coalitions for a more collective security arrangement. Advance technology weapons, platforms, and sensors will significantly increase the capabilities of some forces. Information technology (IT) will be vital to military operations for those who can process, analyze, prioritize, disseminate, and act upon information quickly and effectively^[19] (....and for those who can afford it). A world of robotics and unmanned vehicles will become a part of everyday life to include the military. Our

adversaries will seek to exploit our vulnerabilities by asymmetric means: information attacks, WMD, infrastructure attacks, terrorism, and the infliction of unacceptable casualties.^[20] In addition the adversary will apply asymmetric means by attacking our will to fight, deny access to forward locations, move the fight to urban areas, and combine all approaches for even greater synergy.^[21] The demand for U.S. presence overseas is not likely to diminish nor will the role of U.S. and allied forces in humanitarian missions. Military forces of developed countries will become smaller but more capable due to technological advances. On the other hand, armed forces of states with improving economies will field large armed forces as symbols of sovereignty and emerging regional status. Weapons will become more portable and lethal. Forces then will correspondingly become more mobile complicating the U.S.'s ability to target such foes.^[22]

Terrorism and International Crime

Sophistication of terrorist acts will increase. Increased use of WMD may occur, such as seen in Japan during the nerve gas incident at an urban train station. Some collaboration between states, terrorism and international organized crime is likely.^[23] There will probably be an increase in "non-affiliated" terrorism. That is, terrorism caused by individuals having no organizational ties or commitment. It is this terrorist or rogue warrior who can be bought to conduct terrorist acts for groups or governments with virtually no connectable ties to that group or government. They are very mobile and extremely lethal.^[24]

A FINAL WORD

As one can see, the strategic environment of the future poses numerous challenges for the U.S., its armed forces, and its other agencies of national power. The National Military Strategy sums it up rather well:

"The strategic environment facing us is complex, dynamic, and uncertain. If the United States were to withdraw from international commitments, forsake its leadership responsibilities, or relinquish military superiority, the world would become more dangerous and the threats to U.S. interests would increase. It is in this environment that U.S. Armed Forces must carry out their tasks to protect America and its interests."^[25]

The world is not characterized by 19th century Europe's balance of power, nor is it characterized by the collective security of the Bismarckian alliance system. Ever since 1989 even the predictability of a two superpower cold war has been removed. Today we live in an age of absolute uncertainty.... in which only one nation has the national power to positively influence the planet we reside. How we establish our NMS and shape our defense forces for this future will determine the fate of this great nation and the world.

NOTES

[1] Joint Vision 2010 (Washington D.C.: Chairman of the Joint Chiefs of Staff, 1997), p. 3.

[2] Joint Vision 2010. pp. 3-4.

[3] Report of the Quadrennial Defense Review. (Washington D.C.: Secretary of Defense, 1997), p.8.

[4] Colonel Paul Herbert, "Joint Strategic Review" briefing, Quantico, VA., 2 Oct. 1997.

[5] Concept for Future Joint Operations, Expanding Joint Vision 2010 (Fort Monroe: Commander, Joint Warfighting Center, 1997), p. 8.

[6] Transforming Defense. National Security in the 21st Century (Arlington: Report of the National Defense Panel, 1997) pp. 6-7.

- [7] "Joint Strategic Review" briefing.
- [8] Concept for Future Joint Operations. Expanding Joint Vision 2010. pp. 8-9.
- [9] Transforming Defense. National Security in the 21st Century, p. 7.
- [10] "Joint Strategic Review" briefing.
- [11] Transforming Defense, National Security in the 21st Century. p. 7.
- [12] Report of the Quadrennial Defense Review p. 5.
- [13] "Joint Strategic Review" briefing.
- [14] Concept for Future Joint Operations. Expanding Joint Vision 2010. p. 8.
- [15] Transforming Defense, National Security in the 21st Century. p. 6.
- [16] "Joint Strategic Review" briefing.
- [17] "Joint Strategic Review" briefing.
- [18] Concept for Future Joint Operations, Expanding Joint Vision 2010 p. 9.
- [19] *ibid.*
- [20] "Joint Strategic Review" briefing.
- [21] Transforming Defense, National Security in the 21st Century, p. 11.
- [22] Concept for Future Joint Operations, Expanding Joint Vision 2010, p. 10.
- [23] "Joint Strategic Review" briefing.
- [24] Dr. Kamal A. Beyoghlow, "Religious Extremism and Terrorism: Threat and Response," lecture, Marine Corps War College, Quantico, 1 Dec. 1997.
- [25] National Military Strategy (Washington D.C.: Chairman of the Joint Chiefs of Staff, 1997) p. 10.

CHAPTER 3

NATIONAL STRATEGY

The National Military Strategy (NMS) published in 1997 is a strategy that is designed for both the present and future. It implements the guidance of the National Security Strategy and the QDR. The NMS coupled with Joint Vision 2010 (JV 2010) provides the U.S. military establishment a benchmark for Service and Unified Command vision and direction. The Quadrennial Defense Review (QDR) required by the Military Force Structure Review Act was based on much of the information resulting from the Joint Strategic Review (JSR).

CONCLUSIONS FROM THE JOINT STRATEGIC REVIEW

Since the JSR was the opening process for which the QDR, NMS, and IV 2010 were based, it is important to gather an understanding of the JSR conclusions which are as follows:

It is probable that more than one regional power will have the will and capability to challenge the U.S. militarily in 2010. The will - due to nationalism, xenophobia, and competing interests/ideology. The capability - due to available wealth and technology diffusion. Also likely is a challenging regional power would miscalculate U.S. interests and resolve.

Certain components of our existing NMS: peacetime engagement; deterrence and conflict prevention; and fight and win; remain valid and appropriate through 2010.

Peacetime engagement will be crucial to shaping the strategic environment through 2010.

Overseas presence and power projection remain vital.

Global access to lines of communications, en route infrastructure, and other important facilities will be challenged by political hesitation/opposition, quality of foreign infrastructure and facilities, chaotic internal conditions, and missile proliferation.

It will be harder to prevent and deter the use of WMD, particularly chemical and biological weapons.

The U.S. public is able to accept the risk of casualties as long as they understand that: important national interests are at stake; military operations are conducted competently; they and their elected representatives have been kept fully informed; and the effort is consistent with fundamental American values.

Unilateral military capabilities remain essential to building strong coalitions. [No one wants to join a losing team]

Space control will become essential to joint and combined campaigns.

The demands on timely intelligence collection and analysis will increase significantly.

Military operations in general will require a more extensive process of interagency coordination in achieving unity of effort.

Use of uniformed services to support civil authorities domestically unlikely to decrease.^[1]

These conclusions have helped to shape the NMS and have given IV 2010 a basis for the future.

NATIONAL MILITARY STRATEGY

U.S. NMS is made up of three elements: shape..., the international environment; respond... to full spectrum of crises; and prepare now... for an uncertain future.

Shape

U.S. armed forces shape the international environment primarily through inherent deterrent qualities and peacetime engagement. They must promote world-wide stability by protecting and promoting U.S. interests and regional security objectives. U.S. military forces must prevent or reduce conflicts and threats by providing a degree of fundamental security and by using their unique operational and logistical capabilities to help civil initiatives succeed. Finally, by providing peacetime deterrence, an element of NMS even during the cold war, the U.S. military prevents potential adversaries from taking aggressive actions that threaten our interests,

allies, partners, or friends. It is the most important contribution to the shaping element of the President's strategy.^[2]

Respond

Responding to the full spectrum of crises means conducting military operations, from humanitarian assistance to fighting and winning major theater wars (MTWs) and conducting concurrent smaller-scale contingencies. It also means responding from a posture of global engagement, that is the U.S. will need to be selective in undertaking substantial engagement activities. As in shaping, the U.S. military must have the capability of enforcing sanctions or conducting strikes in order to have the credible capacity to coerce or deter aggression. It must also take the form of a global power possessing the capability to deter and defeat nearly simultaneous, large-scale, cross border aggression in two distant theaters in overlapping time frames, preferably in concert with regional allies.^[3] As a point of information, it was this very point the NDP disagreed with in the NMS. According to the NDP, the two MTW construct was useful in determining what post-cold war forces remain but it is fast becoming an inhibitor for reaching the capabilities we will need in the 2010-2020 time frame.^[4] Nevertheless, the final point on responding is the need for U.S. armed forces to be able to conduct multiple, concurrent, smaller-scale contingency operations. Future challenges outlined in the preceding section and chapter point to this capability. Rapidly emerging are these kinds of operations such as Operation Sea Angel in Bangladesh (humanitarian relief), Operation Assured Response in Liberia (non-combatant evacuation), and even more recent examples like Haiti and Bosnia.

Prepare Now

JV 2010 is an element of the NMS. JV 2010 is about "preparing now" for an uncertain future in a joint environment. A clear understanding of both, elements of the NMS and more specifically, the concepts under JV 2010 are key for determining the future of the main battle tank.

The four operational concepts developed under the JV 2010 construct designed to achieve "full spectrum dominance" are, **dominant maneuver, precision engagement, full dimensional protection, and focused logistics.**^[5] Any future developments by the services or unified commands in weapons, operational concepts, or doctrinal requirements must fall within the parameters of these four JV 2010 concepts. Existing organizations and processes such as the Joint Requirements Oversight Council (JROC) and the Joint Warfighting Capabilities Assessment (JWCA) are used to ensure single focus toward the future within the JV 2010 construct.

JV 2010's full spectrum dominance means that these four operational concepts will enable the U.S. to dominate the full range of military operations from humanitarian assistance, through peace operations, up to and including the highest intensity conflict.^[6]

JV 2010 defines dominant maneuver:

"Will be the multidimensional application of information, engagement, and mobility capabilities to position and employ widely dispersed joint air, land, sea, and space forces to accomplish the assigned operational tasks. Dominant maneuver will require forces that are adept at conducting sustained and synchronized operations from dispersed locations."^[7]

This concept will require forces to outpace and outmaneuver the enemy. Forces with the capability to widely disperse, protect themselves, and reduce build-up time and footprint will be required. A more agile, faster moving joint operation, which will combine air, land, and maritime

forces to more effectively deliver decisive combat power will be the hallmark of dominant maneuver.^[8]

JV 2010 explains precision engagement:

“It will consist of a system of systems that enables our forces to locate the objective or target, provide responsive command and control, generate the desired effect, assess our level of success, and retain the flexibility to re-engage with precision when required.”^[9]

The use of precision weapons systems with extended ranges in both direct and indirect modes having lethal effects on targets will allow the shaping of the battlespace while enhancing the protection of our forces. Precision engagement will use information operations to tie together high fidelity target acquisition, prioritized requirements, and command and control of joint forces. Delivery accuracy, low observable technologies, accurate aerial deliveries, discriminate weapons strikes, and precise all-weather stand-off capability will characterize precision engagement.^[10]

Full-dimensional protection became increasingly important with the Khobar Towers incident. Protection of U.S. forces while forward deployed is of vital importance in a world where information and media can influence American popular support. JV 2010 defines the prerequisite for full-dimensional protection:

“...will be control of the battlespace to ensure our forces can maintain freedom of action during deployment, maneuver and engagement, while providing multi-layered defenses for our forces and facilities at all levels. Active and passive measures will be combined to provide a more seamless joint architecture for force protection, which will leverage the contributions of individual Services, systems, and echelons.”^[11]

This full-dimensional protection will include such things as: information superiority and dispersal to increase our warning of attacks; new sensors and information dissemination systems will be deployed to detect chemical and biological attack; enhanced deception and camouflage measures; and a joint restoration capability against the effects of WMD.^[12]

Power cannot be projected forward for any sustained period of time without adequate and comprehensive logistics. JV 2010 provides vision for 21st century logistics:

"...the fusion of information, logistics, and transportation technologies to provide rapid crisis response, to track and shift assets even while enroute, and to deliver tailored logistics packages and sustainment directly at the strategic, operational, and tactical level of operations."^[13]

Information technologies will be used to transition from the rigid bulky logistical systems to modular, specifically tailored combat service support packages. These information technologies will also enhance airlift, sealift, and pre-positioning capabilities to lighten deployment loads, provide for smaller logistical footprints, while decreasing vulnerabilities associated with extended logistical lines of communication.^[14]

IN CLOSING

The three elements of the NMS have provided this nation a framework for its current national defense and a future direction from which it will be able to man, equip, and train the U.S. armed forces for tomorrow. It is from this information the U.S. Marine Corps has interpreted its future direction for its role in the 21st century... it is from that the determination of whether a future main battle tank is required.

NOTES

[1] Colonel Paul Herbert, "Joint Strategic Review" briefing, Quantico, VA., 2 Oct. 1997.

[2] National Military Strategy (Washington D.C.: Chairman of the Joint Chiefs of Staff 1997), pp. 12-14.

[3] National Military Strategy p. 15.

[4] Transforming Defense. National Security in the 21st Century (Arlington: Report of the

National Defense Panel, 1997), p. 23.

[5] Joint Vision 2010 (Washington D.C.: Chairman of the Joint Chiefs of Staff, 1997), p. 1.

[6] Joint Vision 2010. p. 25.

[7] Joint Vision 2010. p. 20.

[8] *ibid.*

[9] Joint Vision 2010. p. 21.

[10] *ibid.*

[11] Joint Vision 2010 pp. 23-24.

[12] *ibid.*

[13] Joint Vision 2010. p. 24.

[14] *ibid.*

CHAPTER 4

U.S. MARINE CORPS ROLE IN THE 21ST CENTURY

The Marine Corps, just as the entire Department of Defense, has been paving the way toward the future. Every issue, project, and program is designed to answer the challenge the future, strategic environment has presented to this nation's defense in the 21st century. No one in the Corps has been more outspoken about the future of modern warfare, the future battlefield, and the best kind of Marine Corps to meet those challenges than General C.C. Krulak, Commandant of the Marine Corps. He stated in his *Planning Guidance Frag Order* of 31 August 1997:

"The Marine Corps revolutionized the art of warfare with the introduction and perfection of the air-ground, combined-arms team. The beauty of combined arms is that, if planned for and executed properly, it places our adversaries in a position from which they have few good choices. If they attempt to avoid the effects of one of our capabilities, they expose themselves to exploitation by another. The combined-arms team is, and will remain, the foundation of the Corps' warfighting capability, but the changing nature of warfare requires us to extend that foundation to other areas of our national power projection spectrum"^[1]

The quote speaks to how the Marine Corps has framed its outlook on the future. As presented to the National Defense Panel by Marine Corps representatives, "In other words, we see no need to reinvent ourselves or our ethos. Instead, we need to focus only on some organizational and operational re-engineering."^[2] Even though this may, in many ways, understate the level of change within the Marine Corps today, the point to be made is, the Marine Corps sees itself as already ideally suited for future conflict as defined or predicted by the President and the Chairman of the Joint Chiefs of Staff. The Marine Corps never saw itself, nor did it equip itself, train itself, or write doctrine to strictly support the Cold War scenario. It has seen itself as America's force in readiness especially when the nation is the least ready. The Corps has always taken very seriously

the Marine Corps Strategic Concept outlined by the House Armed Services Committee of the Congress of the United States, 1952:

"A versatile, expeditionary force in readiness..."

"A balanced Force for a Naval Campaign and a Ground and Air Striking Force..."

"Always at a high state of combat readiness..."

"Ready to suppress or contain international disturbances short of war..."

"To be the most ready when the Nation generally is least ready..."^[3]

With this said, the next several pages will outline in more specific terms where the Marine Corps feels it needs to be heading to succeed in the 21st century. This chapter is the basis upon which Chapter 6 will focus in order to determine whether the Marine Corps of the future will require a main battle tank.

THE CHANGING FACE OF WARFARE

Chapter 2 explored in detail the predictions of the strategic environment in 2010 and beyond. The Marine Corps lists some additional predictions. Eighty percent of the world's megacities (cities with populations over ten million) will be found within 200 miles of a major ocean or sea by the year 2020. By that same time, seven out of twelve of the world's largest economies will be located along the Pacific and Indian Ocean littorals. The vast majority of all global trade, and most energy resources, will continue to flow by sea; in Asia, seaborne trade will quadruple in the next 25 years. The majority of potential conflicts will be at the lower end of the range of military operations. Finally, the Marine Corps concludes that all the destabilizing factors mentioned in Chapter 2 and above will affect the world's littorals, where 70 percent of the world's population now lives. Crises and conflict will expand around the globe.^[4] Just as at the

national level, the Marine Corps takes this view of the future and translates it into requirements and capabilities.

CORE COMPETENCIES

There are six core competencies the Marine Corps defines as what Marines do and how they operate. These competencies have served our nation well in the past and will continue to serve it well into the future. First is **expeditionary readiness** which essentially means being ever-ready to win our nation's first battles and prepare to defeat the "opponent after next." It also means Marines can flourish under conditions of uncertainty. The second competency is **combined arms operations** which means the Marine Corps must be able to react immediately on short notice and without immediate support from the Army and Air Force, thus requiring an organic, combined arms capability embodied institutionally. The third core competency is **expeditionary operations** which considers host nation support a luxury and is designed to bring everything necessary to accomplish the mission...from individual equipment up to and including airfields and hospitals. Fourth is **sea-based operations** defined as a highly ready, combined arms Marine Air Ground Task Force (MAGTF), operating from a mobile, protected sea base, providing the National Command Authorities (NCA) with unimpeded and politically unencumbered access to potential trouble spots around the world. Fifth is **forcible entry from the sea** which is now defined as uninterrupted movement of forces from ships located far over-the-horizon directly to decisive objectives. Lastly, is **reserve integration**. The Marine Corps can ill afford a pause to call up its reserves during an emerging crisis so it is to have a carefully crafted series of reserve integration plans to augment or reinforce crisis response

missions especially at the high end of the conflict spectrum.^[5] From these core competencies come Marine Corps goals and objectives.

GOALS AND OBJECTIVES

The Marine Corps Master Plan defines eight major goals with associated objectives. Since the Corps' purpose is to "make Marines and win our nation's battles," several of the goals deal specifically with making Marines. For purposes of this paper, only those goals associated directly with warfighting will be discussed in detail. Understand however, the Marine Corps views the individual Marine as the world's finest military professional and as the bedrock upon which it will build a superb armed force.

The first goal (A): Provide the nation with a flexible, responsive, naval, combined arms total force. It lists nine objectives:

- * Maintain and improve the ability to provide timely and effective task organized forces to unified commanders and other service and government departments for other missions as the President may direct.
- * Maintain an organic, expeditionary fire support capability.
- * Maintain an organic self-sustainment capability.
- * Exploit advances in information and logistics technologies that reduce our logistical footprint and reliance ashore.
- * Maintain the capability to support joint, interagency and multi-national operations.
- * Maintain a robust, organic aviation capability.
- * Maintain the capability to conduct and sustain operations from the sea with amphibious forces.
- * Develop and transition to an enhanced Maritime Prepositioning Force capability.

* Maintain and evolve a command and control capability that enables effective operations inside the opponent's decision-making cycle.^[6]

The third goal or Goal C is: Develop and provide relevant and easily integrated Marine forces to the unified commanders. It is composed of 12 objectives germane to the subject of this paper. They are:

- * Continue to foster our expeditionary mindset.
- * Provide combat-ready Marine forces that are interoperable, rapidly deployable, sustainable, and employable immediately upon arrival.
- * Maintain the capability to rapidly reconstitute and redeploy.
- * Develop, foster, and maintain adaptable command relationships.
- * Provide general purpose forces capable of operating across the full range of military operations.
- * Structure and source Marine Component Headquarters capable of responding to a Unified Commander's requirements and directing and supporting assigned operational forces.
- * Continue to refine Total Force warfighting capabilities.
- * Continue developing command and control systems that are fully interoperable with joint systems.
- * Maintain and enhance our credibility as the Nation's premier force in readiness.
- * Continue to provide disciplined and reliable individuals and units to operate in an environment of uncertainty.
- * Create a command climate that encourages initiative and accepts honest mistakes as part of the professional growth process.
- * Continue to make every Marine a rifleman.^[7]

The nature of these goals and objectives can be summed up by the Commandant's "Three Block War," **humanitarian assistance, combat operations and peacekeeping.**^[8] These are the things he feels the Marine Corps will be required to do in the future. How we will fight will be

determined by the pace and scope of three broad competitions. The first is between power projection powers and state, intra-state, and perhaps non-state actors employing increasingly sophisticated and asymmetrical regional anti-access strategies. The second is between "hidiers and finders." It is competition between cultural deception schemes versus opposing cognitive recognition strategies, and those who purposely blend into complex operational environments such as open societies and urban areas versus forces tasked to find and engage them. Finally, the third competition is between the offense and the defense. It is the competition between precision strike and active defenses. It will affect the broader power projection and anti-access competition, how U.S. forces will conduct operational maneuver and close combat and how and when non-state actors will choose to engage our deployed forces.^[9]

Additionally the Marine Corps sees itself as deploying in three ways: 1) By sea on amphibious ships as forward presence forces and as an enabler for follow-on forces. 2) By air as air contingency forces in response to crises. 3) By air or sea to unite with maritime prepositioning ships strategically located around the globe to establish sustainable forward presence and power projection.

MARINE CORPS INITIATIVES

The Marine Corps has embarked on several major initiatives to deal with today's changing environment and tomorrow's future. Marine Corps core competencies, goals, objectives, predictions of tasks required to conduct on the future battlefield, and the way the Corps will deploy have a hand in all five major initiatives.

Sea Dragon

The first major initiative is the Commandant's Sea Dragon process. This is the single most important mechanism for change within the Marine Corps because it institutionalizes change within the service. It is the Corps' philosophical commitment to innovative change by energizing and encouraging challenges to the "business as usual" approach.^[10] The Commandant's Warfighting Lab (CWL), now called the Marine Corps Warfighting Lab (MCWL) is at the center of this process and is on the cutting edge of innovation. Fed by suggestions Corps-wide, it embarks on experimentation and wargaming. A series of advanced warfighting experiments (AWEs) and limited objective experiments (LOEs) have been scheduled from July 1996 through February 2001. The three major AWEs are **Hunter Warrior, Urban Warrior, and Capable Warrior**. Hunter Warrior explored whether it was possible for a small Marine force to contain a developing crisis and prevent it from becoming a major contingency. It attempted to answer the question, could we significantly extend the area of influence of a modest forward afloat expeditionary force, and also significantly increase its effectiveness within that expanded area of influence?^[11] It capitalized on small teams using high-tech digital communications, precision guided munitions, and innovative logistical techniques.

Urban Warrior, the current experiment of the MCWL, is focused on developing new doctrine, tactics, techniques, and equipment designed for future urban conflict. The Marine Corps' focus on fighting in the world's future urbanized littorals stems from strategic environmental predictions already cited and from current trends. In the last 20 years the U.S. military has deployed a "significant" ground force in 27 operations. Of these, 11 were located in urban and rural areas, 10 were strictly urban, and only six were other than urban. During WWII Europe was the most urbanized area in the world. It was only 20 percent urbanized. In 2025 it is

projected 47-65 percent of the world's population will live in urban environments.^[12] One can see why the Marine Corps is focusing on urban warfare, something no service has yet mastered. The future of a main battle tank in an urban environment holds many challenges that will be discussed in Chapter 6. According to Colonel R. A. Gangle USMC (Ret), Senior Operational Advisor, MCWL, the environments the Marine Corps plans on fighting in are (in order of most likely to least likely), urban, wooded rural, mountain, and desert. He feels cold weather operations are not even to be considered. He added that the Marine Corps training focus must shift from mid-intensity combat training to contingency operations focus, specifically urban warfare. He does admit however, that we must always retain the ability to fight in an MTW. One other point he makes is that the Marine Corps has never fielded any equipment strictly for use in an urban environment.^[13] Marine Corps acquisition programs will see a major influence from the Corps' emphasis on fighting the urban battle. How the Marine Corps envisions its requirements on the future battlefield and any corresponding shifts in doctrine will drive the types of equipment and specific designs of equipment to be fielded. Certainly, the tank will be no exception.

Capable Warrior is the larger scale AWE which will experiment with larger force projection combined with some of what was discovered in the preceding experiments. It will be an attempt to put much of what was learned, together in greater scale. The designs of this AWE are still being developed.

Operational Maneuver from the Sea

The second major initiative is an operational concept derived from the U.S. Navy's transition from a blue water Navy to one focused toward the littorals, outlined in White Papers, "From the Sea" and "Forward from the Sea." Operational Maneuver from the Sea (OMFTS) is

the Marine Corps capstone operational concept for operations in the littorals. OMFTS is the maneuver of naval forces at the operational level and should be directed toward enemy critical vulnerabilities. It is the application of maneuver warfare to a maritime campaign.^[14] It fits within JV 2010's dominant maneuver concept and comprises six principles: 1) Focuses on an operational objective. 2) Uses the sea as maneuver space. 3) Generates overwhelming tempo and momentum. 4) Pits strength against weakness. 5) Emphasizes intelligence, deceptions, and flexibility, and 5) Integrates all organic, joint, and combined assets.^[15]

The USMC pamphlet on OMFTS continues to describe important aspects of the concept:

"OMFTS treats the littoral as a single environment in which the cooperation of units on land, sea, and in the air is based on a shared vision of what must be done... OMFTS requires rapid movement, not merely from ship to shore, but from ship to objectives that may be miles away from blue water and from inland positions back to offshore vessels. OMFTS must be of use in a wide variety of situations, ranging from humanitarian relief to a high stakes struggle against a rising superpower."^[16]

A component of OMFTS is the concept of Ship to Objective Maneuver (STOM). It aims to provide future naval expeditionary forces with an ability to conduct sustained, high tempo, combined arms maneuver from a protected sea base. It uses the combined effects of the Advanced Amphibious Assault Vehicle (AAAV to be introduced in 2006), the MV 22 Osprey tilt rotor aircraft (to be introduced in 2003), and the Landing Craft Air Cushion (LCAC currently in the inventory) to seek to create multi-dimensional problems for an enemy throughout the depth of his vital areas (all three of these systems reach full operational capability in 2014).^[17] STOM focuses on amphibious forces moving from the ship directly to their objectives without necessarily any major equipment or logistical buildup ashore. This eliminates vulnerable rear areas in chaotic crises and allows for quicker back-loading and potential reinsertion elsewhere in the area of operation.

In order to support this, OMFTS/STOM require an innovative and revolutionary aspect for logistical support. Advanced seabasing is a concept currently being developed but outlines the revolution in combat support and combat service support. It will allow Marine and Navy forces to operate freely on the periphery of enemy long range fire systems. From a logistics standpoint, advanced seabasing means a dispersed, Walmart-style wholesale containerized system, operating from standoff, over-the-horizon distances having maintenance and resupply items delivered by parafoils, MV22s, CH53s, caches, or unmanned aerial vehicles (UAVs).^[18]

The concept for Maritime Preposition Force (MPF) 2010 supports OMFTS/STOM by providing a triad of capabilities: fast deployment, reinforcement, and sustained seabasing. These are described in the MPF 2010 Concept Paper as:

"The **fast deployment** capability will deploy the combat essential equipment for a Marine Expeditionary Unit or similarly-sized Special Purpose MAGTF [Marine Air Ground Task Force], along with a limited amount of palletized cargo.

The **reinforcement** capability will deploy the equipment and 30-days' sustainment for a Marine Expeditionary Force [MEF] (forward).

The **sustained sea basing** capability will furnish a full range of logistics support, as well as the conduit to strategic bases through which *MPF 2010 and Beyond* will provide indefinite sustainment for a Marine Expeditionary Force."^[19]

Acquisitions

The acquisition of equipment to support emerging concepts and doctrine is the third major Marine Corps initiative. The three major pieces of equipment to support OMFTS/STOM have been mentioned above, the AAV, MV22, and the LCAC. In addition to these, the draft 1998 Marine Corps Concepts and Issue (Chapter 4) document contains 54 major acquisition programs designed to support the execution of OMFTS and aggressively exploit technological

advancements in order to improve readiness; enhance intelligence and information processing; increase the speed, mobility, and supporting firepower of expeditionary forces; and significantly minimize potential casualties during future operations.^[20]

Non-lethal Weapons (NLW) Leadership

The Marine Corps has taken the lead in study of non-lethal weapons. The assumption of NLW leadership is the fourth major Marine Corps initiative. Currently the Commandant is the DoD NLW Executive Agent working for the Under Secretary of Defense for Acquisition and Technology. Since the Marine Corps' focus is shifting to urban conflict and since it has already been involved heavily in humanitarian and peacekeeping operations, it has discovered non-lethal weapons allow for an increasing continuum of response. Non-lethals have application in the full spectrum of conflict and will be required in the future strategic environment. Marine Corps equipment, to include the future tank, may be required to have dual use functions, lethal and non-lethal capabilities.

Chemical Biological Incident Response Force (CBIRF)

With the ever increasing proliferation and threat of WMD especially chemical and biological weapons, the Commandant directed the implementation of a CBIRF in July 1995. On 1 April 1996 the CBIRF was activated.^[21] It has deployed to support the Olympic Games in Atlanta, the Presidential Inauguration, and the Summit of Eight in Denver. Future direction for this force is toward developing countermeasures, force-protection training, and equipment support packages for deploying Marine Expeditionary Units (Special Operations Capable) (MEU(SOC)). A second direction would be toward assisting federal, state, and local response

forces in developing their own training programs on how to manage the consequences of a chemical or biological incident.^[22] The CBIRF is a perfect example of the implementation of additional U.S. military capability in response to the nature of the future strategic environment.

SOME FINAL WORDS

As it is plain to see, the Marine Corps is changing. It has institutionalized change. It has already taken serious steps toward shaping itself toward a changing future. We are looking at new strategic paradigms based on a drastically changing world. The Marine Corps of today is preparing for the future just as in 1919 when the Commandant, General George Barnett, and his successor General John A. Lejeune embraced the operational concept of the amphibious assault. The Marine Corps sees a new direction, using new and innovative operational concepts, service doctrine, tactics, techniques, and equipment. It is important to remember, these innovations based upon vision are not intended to reinvent the Marine Corps or its ethos. Instead, it is only intended for some organizational and operational re-engineering.

NOTES

[1] "Commandant's Planning Guidance, Frag Order," (Washington D.C., Office of the Commandant of the U.S. Marine Corps, 1997), p. 8.

[2] Lieutenant General M. R. Steele, "A Corps of Marines for the 21st Century...Plotting the Transformation for the Nation's Force-in-Readiness" briefing to the National Defense Panel, Arlington. 8 Aug. 1997.

[3] 1997 U.S. Marine Corps Concepts and Issues (Washington D.C.: Programs and Resources Department, Headquarters U.S. Marine Corps, 1997), p. 10.

[4] U.S. Marine Corps Master Plan for the 21st Century (Washington D.C.: Plans, Policies, and Operations Department, Headquarters, U.S. Marine Corps, undated), pp. 4-6.

- [5] U.S. Marine Corps Master Plan for the 21st Century pp. 9-10.
- [6] U.S. Marine Corps Master Plan for the 21st Century. p. 11.
- [7] U.S. Marine Corps Master Plan for the 21st Century. p. 12.
- [8] Brigadier General W. C. Gregson, "Preparing for the Day after Tomorrow," briefing to the Marine Corps War College, Arlington, 16 Dec. 1997.
- [9] "A Corps of Marines for the 21st Century...Plotting the Transformation for the Nation's Force-in-Readiness" briefing to the National Defense Panel.
- [10] 1997 U.S. Marine Corps Concepts and Issues. p. 22.
- [11] Exploiting Hunter Warrior (Quantico, Marine Corps Warfighting Laboratory, 1997), p. 3.
- [12] Personal interview with Colonel R. A. Gangle USMC (Ret), Senior Operational Advisor, Marine Corps Warfighting Laboratory, 23 Oct. 1997.
- [13] Personal interview with Colonel R. A. Gangle.
- [14] "A Corps of Marines for the 21st Century...Plotting the Transformation for the Nation's Force-in-Readiness" briefing to the National Defense Panel.
- [15] Operational Maneuver from the Sea- pamphlet (Quantico: Marine Corps Combat Development Command, 1996), p. 11.
- [16] Operational Maneuver from the Sea. pp. 2 1-22.
- [17] "A Corps of Marines for the 21st Century...Plotting the Transformation for the Nation's Force-in-Readiness" briefing to the National Defense Panel.
- [18] *ibid.*
- [19] Maritime Prepositioning Force 2010 and Beyond, concept paper (Quantico: Marine Corps Combat Development Command, undated), p. 4.
- [20] 1998 U.S. Marine Corps Concepts and Issues Chapter 4 draft (Washington D.C.: Programs and Resources Department, Headquarters U.S. Marine Corps. 1997)
- [21] Headquarters U.S. Marine Corps Plans, Policies, and Operations, "U.S. Marine Corps, Initiatives and Innovations in an Uncertain World" briefing to Ms Flournoy DASD (5), date unspecified.
- [22] "Commandant's Planning Guidance, Frag Order," p. 2.

CHAPTER 5

FUTURE WEAPON PROLIFERATION AND TECHNOLOGIES

The threat to the U.S. national security and U.S. foreign interests is changing. This chapter will attempt to quantify some of that change in terms of weapons types, numbers, and developments. During the Cold War we talked in terms of Soviet Bloc threat weapons systems, developed and produced by the Soviet Union and/or Warsaw Pact countries. U.S. allies tended to purchase U.S. weapons while Soviet Bloc weapons dominated threat countries. Now, however, weapons proliferation is a function of the globalized market economic environment. Countries from every corner of the world are either buying, selling, producing, or developing conventional style weapons as part of their economy. It is important to understand the extent weapons proliferation currently is increasing and appreciate the effects it will have in the future. This chapter will discuss this importance in detail. Equally important is how future technology will be shaping the nature of weapon systems. Weapons proliferation and technology are variables in the equation of determining whether the Marine Corps of the future will have a requirement for a main battle tank.

GROUND WEAPONS PROLIFERATION

Weapons technology is intimately linked to the information sharing increasingly becoming more pronounced as we enter the 21st century. It is this widely distributed technology that sets a stage for increased proliferation of weapons systems. The cheaper the cost of certain weapons the more appealing they become to not only developing or undeveloped countries but also developed countries trying to reduce military budgets. Wide spread free market economies are

perfect environments for greater weapons proliferation. When developing economies such as Russia and China are attempting to increase gross domestic product (GDP) and their major existing industries are weapons producers then it seems logical to assume these are the first markets that will be exploited. As nations such as these compete, other traditional weapons merchants such as France, Germany, Israel, and even the U.S. will compete to even greater extents to sell their products... and so the "game" begins. Supply and demand, wealthier economies, lower prices, and greater supply all lend themselves toward an environment characterized by increased weapons proliferation.

Another element promoting this proliferation trend is the huge glut of weapons resulting from draw-downs in the standing armies of the major international players. As Thomas Hammett, Intelligence Analyst at the U.S. Army Armor Center, Ft Knox, KY, states:

"The Conventional Forces in Europe (CFE) Treaty caused a huge excess of weapons, vehicles, and spare parts. To add to the problem, the industrialized countries of the world, seeing a world with a greater number of conflicts, perceived a need to maintain baseline military establishments fielded with modern equipment that retained a technological edge over that of the lessor developed nations..."^[1]

In essence, Thomas Hammett is pointing out that even more of the older equipment is being made available to potential customers and at very low cost. DIA has reported that some former Warsaw Pact countries will sell older tanks (T-55/62) at the rate of \$1.00 per pound, which means a T-55 would cost about \$80,000. This phenomenon alone is not a direct threat to the U.S. per say, but other countries realizing the increased availability of older weapons systems are seeking to create a new economic market niche by developing and producing conversion packages and retrofit kits such as applique armor, explosive reactive armor (ERA), upgraded armament packages, etc. Meanwhile, the buyer creates and grows a larger, cheaper, yet lethal and survivable military capability. The resulting effect is a potentially more dangerous world. Figure

1 lists the various countries in the world in 1993-94 who owned 300 or more tanks T-54/55 or better. Note, a U.S. Army armor division has 259 tanks and the two (1.5. Marine Corps regular tank battalions combined have 116 tanks.

Afghanistan	462	Mongolia	600
Algeria	860	Netherlands	542
Belarus	1,500	North Korea	3,775
Belgium	334	Pakistan	1,701
Bulgaria	1,470	Peru	300
China	10,000	Poland	2,545
Croatia	650	Romania	786
Cuba	1,000	Russia	36,000
Czech Republic	948	Saudi Arabia	856
Egypt	2,745	Serbia	500
Ethiopia	315	Slovakia	478
France	1,048	South Korea	550
Germany	3,858	Spain	520
Greece	1,155	Sweden	560
Hungary	1,187	Switzerland	920
India	3,150	Syria	4,220
Iran	750	Turkey	1,325
Iraq	2,000	Turkmenistan	900
Israel	2,670	Ukraine	2,300
Italy	1,220	Uzbekistan	300
Japan	973	United Kingdom	1,298
Jordan	858	Vietnam	550
Libya	635	Yemen	1,190

Figure 1. Armor Proliferation

Source: World Defense Almanac 1994-95, Military Technology, Monch Publishing Group.

Recent data show that even Botswana has bought 150 tanks from Belgium. Figure 2 shows current tank inventories by region throughout the world. When Figure 2 is compared to Figure 3,

one observes total inventories on the decline but a significant shift is seen in who owns these tanks.

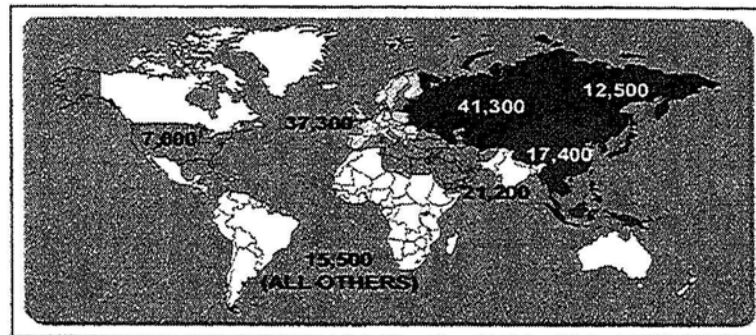


Figure 2. World Tank Inventories (Current)

Source: National Ground Intelligence Center

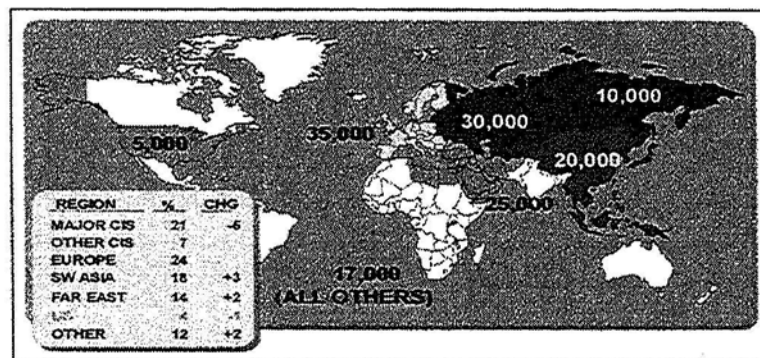


Figure 3. World Tank Inventories (CIRCA 2005)

Source: National Ground Intelligence Center

The BMP-3, a highly capable armored personnel carrier, very survivable and extremely lethal has been sold widely throughout the world. Countries possessing this vehicle are, South Korea, Ukraine, UAE, Russia, Cypress, and Kazakhstan.^[2]

Another lethal weapon system increasingly proliferated world-wide is the anti-tank guided missile (ATGM). Russia, France, China, Sweden, Israel, and South Africa develop ATGMS.

About 123 countries deploy ATGMs, 31 have produced them, and 17 have developed them. Currently there are 56 ATGM systems and variants in service with another 33 in development. These systems can cost as little as \$3,000 and will destroy a \$5M tank or \$20M helicopter.^[3] Since they are very easy to use, the market becomes even greater for the sale of these very dangerous weapons systems.

Armor and anti-armor technologies are becoming more widespread as seen through the development of small arms and ammunition. Up to 69 states can produce small arms and ammunition. Serbia manufactures the world's most lethal rocket-propelled grenade (RPG) weapon with armor penetration exceeding 800mm. They also produce anti-tank rockets (Hornet) that will penetrate more than 600mm. The Russian-made RPG-7 is in general use throughout Africa, Asia, the Middle East, and Eastern Europe (RPG-7 successes against helicopters have been seen in Somalia). Improvements in warheads, including tandem varieties for use against explosive reactive armor (ERA), are keeping pace with armor technologies.^[4] The world's nations will continue to arm themselves at increasing levels. The only bright side of the weapons proliferation picture is that while research and development efforts are increasing, production efforts are decreasing.^[5]

One disadvantage the U.S. will always have, as long as it remains globally engaged, is its requirement to maintain equipment sufficient to deal with the world-wide strategic environment. We are unlike other nations of the world who can tailor their defense strategy, doctrine, and equipment to their own individual geographical, political, and economical situations. The U.S. can ill afford this luxury in the context of our NMS.

GROUND WEAPONS TECHNOLOGIES

Former Secretary of Defense, Dick Cheney said, "Advanced technologies make third-class powers into first-class threats."^[6] We've discussed that the proliferation of these technologies will continue if not increase over the course of the next 10-15 years, but what kinds of weapons technologies will exist then?

One of the major initiatives in armored vehicle technologies is the Suite of Survivability Enhancement Systems (SSES) which is an integrated combination of signature management, sensors, countermeasures, armor, ammunition compartmentation, etc. The specific makeup of the suite may vary from platform to platform and from mission to mission. It follows the survivability model shown in Figure 4.

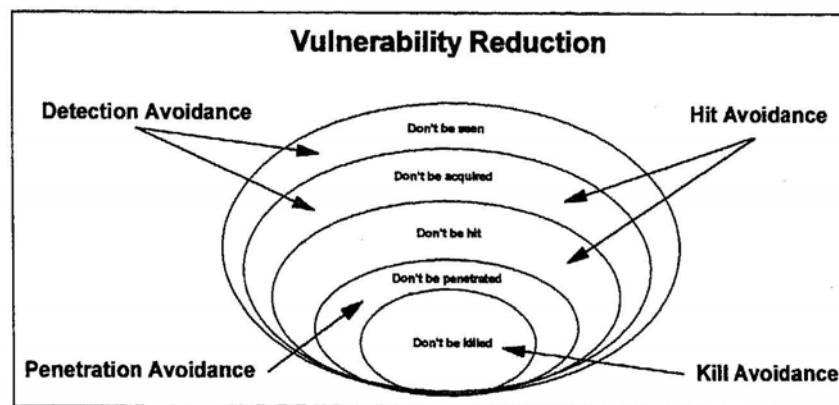


Figure 4. Vulnerability Reduction Model

Source: U.S. Army Armor Center, Ft. Knox, KY

Survivability technologies are designed around the four major avoidance's seen above. Detection avoidance technologies will focus on reducing silhouettes and signature management. Hit avoidance focus is on active protection systems (APSs), electronic warfare countermeasures,

warning sensors, and chemical and kinetic energy protection. Penetration avoidance focuses on armor to defeat APS residual, armor to defeat medium cannons, and mine protection. Kill avoidance technologies will center around compartmentation, integral shielding/liners, crew overpressure, and NBC detectors.

Most of the elements of the SSES are classified yet the existence of some systems are unclassified because of the free market advertising certain countries have conducted to sell their products. Two of these systems are active protective systems (APS), the Drozd and the Arena pictured in Figures 5 and 6. In addition to APS are laser warning receivers and ATGM defense systems. The U.S. Army is even looking at modular armor, whereby the vehicle would have its basic ballistic protection permanently affixed but would have the capability to apply additional armor depending upon the threat environment and mode of strategic mobility available for deployment. The number of survivability programs currently existing in the U.S. is 208. Many of these technologies as well as any others mentioned in this paper have different maturity levels. Some are revolutionary, others are evolutionary and not cost effective,

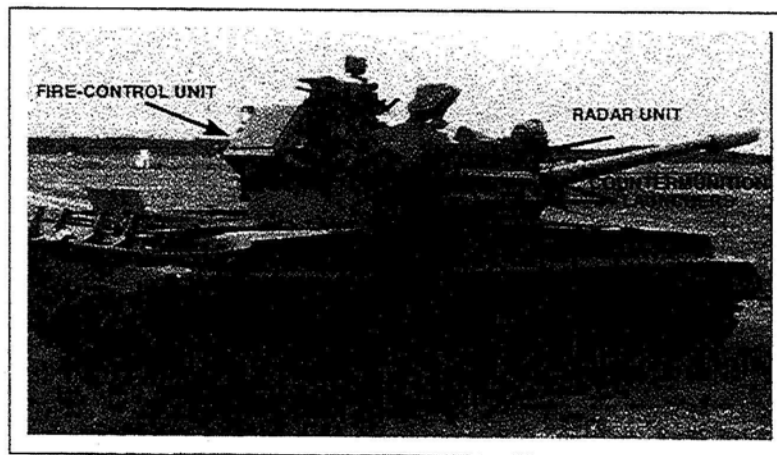


Figure 5. The Drozd APS

Source: Intelligence Branch, U.S. Army Armor Center, Ft. Knox, KY

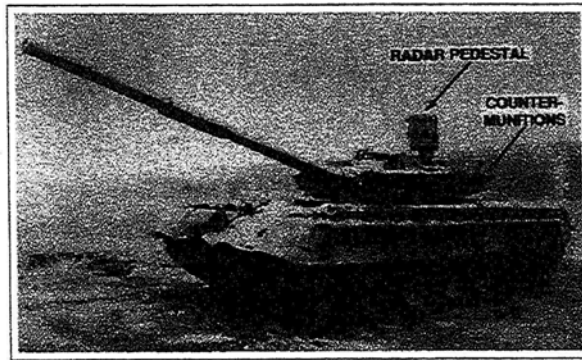


Figure 6. The Arena APS

Source: Intelligence Branch, U.S. Army Armor Center, Ft. Knox, KY

Technology in armaments continues to advance. Electric gun technology is slowly developing and is projected to be mature around 2015. The advantages of the electric railgun are hypervelocity impact physics and hypersonic aeroballistics using small projectiles. Ammunition size is reduced tremendously while the lethality of the projectile is increased. Gun size is also reduced. Electrothermal chemical guns will be available around 2005. Advantages to this system are few since projectile and gun size and weight have not been reduced significantly. The electrothermal chemical gun is an example of evolutionary technology.^[7]

Munitions are also advancing at greater rates. Work has been started on tank munitions with fire and forget capabilities reaching distances of 10km non-line-of-sight. Direct-fire projectiles have evolved to extended penetrator rods achieving up to 34 percent increase in penetration at 2.2kms, compared to current penetrators. Segmented penetration rods have achieved up to 70 percent greater penetration effectiveness.^[8]

ATGM technology is both prolific and varied. Future main improvements include, enhanced night vision capability, increased warhead lethality (multiple warheads, advanced fusing), top attack missile trajectories, improved target acquisition, countermeasure hardened missile and fire control systems, fire and forget systems, and counter-countermeasure techniques against APS. There have been some ATGM developments by European business partnerships whereby the range exceeds 30km, using a tandem warhead with fiber optic guidance.^[9]

Artillery delivered, high-precision munitions have achieved armor kills at 10-70km ranges during tests.^[10] The artillery piece becomes a low cost, low technology, delivery system for a very smart munition. These kinds of systems become extremely appealing to countries who wish to reduce friendly casualties.

The downside to "smart" munitions is excessive costs. Depending upon the munition capability, costs for systems like the Longbow Hellfire can reach up to \$200,000 per munition.^[11] The trade-offs become cost versus benefit. Is it better to have a more expensive delivery system and a cheaper more accurate munition or a very expensive precision munition delivered from an inexpensive delivery system? For many countries the pure economics of the dilemma is more important than any other consideration. The sophisticated defense infrastructures understand they must include the myriad of hidden costs associated with munitions and delivery systems such as costs for training, maintenance, fuel, manpower, etc. Unfortunately, the cost/benefit analysis of determining which weapon systems to procure is not purely quantitative. The qualitative aspect of national military strategy, the future strategic environment to include the threat, budget constraints, and the many maturing technologies all are critical variables in this equation.

NOTES

[1] Thomas Hammett, "The Proliferation Threat," U.S. Army Armor Center, Fort Knox, undated, p. 2.

[2] David M. Phipps, "Armor Intelligence/Threat Briefing," Fort Knox, 21 Oct 1997.

[3] *ibid.*

[4] Hammett pp. 4-5.

[5] "Armor Intelligence/Threat Briefing."

[6] Concept for Future Joint Operations. Expanding Joint Vision 2010 (Fort Monroe: Commander, Joint Warfighting Center, 1997), p. 14.

[7] CPT Joseph M. Taylor, "U.S. Army Armor Center's Survivability Perspective," briefing, Fort Knox, 21 Oct. 1997.

[8] *ibid.*

[9] "Armor Intelligence/Threat Briefing,"

[10] *ibid.*

[11] *ibid.*

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

The context of the following conclusions emerge from the strategic and operational levels of war. Even though some tactical considerations will be discussed, those particular details directly support stated goals or requirements of the National Military Strategy (NMS) or Marine Corps goals and objectives. A healthy understanding of how the three levels of war interrelate is important in understanding the analysis of this chapter. Tactical capabilities may have a direct impact on strategic results. A very poignant point made throughout this paper is that the strategic environment and the strategic threats to U.S. national security or U.S. foreign interests will, in all likelihood, be dealt with by smaller, more effective U.S. military forces. History has demonstrated how small forces make strategic impact. Lebanon in the early 1980s, Panama, and of recent, Haiti and Somalia. A MEU might be all that is required to maintain order out of chaos on a foreign shore vital to U.S. interests. Generally, the success or failure of MEU level operations is at the tactical level. Incorporating the Marine Corps view of how it will accomplish its portion of the NMS for the future, we must look at these contingencies and small force operations when developing requirements for individual weapons systems.

Does the Marine Corps of the future require the use of the main battle tank as defined in Chapter 1 (a survivable, offensively lethal, mobile platform striking shock and fear in the minds and hearts of the enemy)? Granted, a myriad of current weapons systems could already substitute for the individual capabilities of today's tank. This assumption would also remain valid for the future especially with evolving technology. The question really is, does the Marine Corps of the

21st century, based on information in the preceding chapters, really need a platform with all these capabilities?

Another consideration for this analysis is... what is fiscally realistic and what is science fiction? No country, to include the U.S., has unlimited resources. Without getting too bogged down in fiscal and defense budgetary realities, which we all know is a declining phenomenon, let's assume that the development of technologies are only affected through time by money. The requirement for a piece of equipment doesn't change because of resource limitations...only the priorities of those requirements which will ultimately determine the time it takes to fulfill them.

CONCLUSIONS: MAN AND TECHNOLOGY

A future tank could be manned or unmanned. This argument, however, is a distraction from the determination of the overall requirement. Robotics, sensors, remote control unmanned vehicles, unattended mortars (Dragon Fire^[1]), etc. will undoubtedly have a place on the future battlefield but technology is not the panacea. Man creates wars and he will always have to fight them, on the ground, to some extent. Yale history professor, Donald Kagan offers the following point:

"But one must be cautious about claims that new technology will make traditional ground forces marginal or irrelevant. Previous advances in military technology, even when they have had important effects on the character of warfare, have produced exaggerated claims and expectations. After the Franco-Prussian War, the officers of the German general staff ignored the complexities of traditional grand strategy and put their hopes and faith in mastery of the new technology. Theirs was a narrow world of technical marvels, cartography, railroads, communications, weapons systems. They mastered statistical tables, devised intricate mobilization schedules, formulated complicated plans, all of which, however, was not enough to overcome the traditional disadvantages of numbers and geography.

Similarly, British advocates of air power in the interwar years thought they could deter war or win it without the use of ground forces by developing the new technology of "strategic" aerial bombardment."^[2]

Kagan goes on to talk about the Gulf War in that with all the airpower and new technologically advanced "smart" bombs, the ground forces still were required to transit the minefields and occupy Kuwait and southern Iraq to extricate the Iraqi.

General Shalikashvili and the Joint Staff recognize how technology plays into the warfighting equation:

"...one must always remember **that the purpose of technology is to equip the man.** We must not fall prey to the mistaken notion that technology can reduce warfare to simply manning the equipment. **Warriors and leaders are at the heart of all operations; technology and equipment help them accomplish the mission.**"^[3]

If one believes this to be true then we will always need humans to occupy the objectives or deal with the insurgency, or place himself in harms way to accomplish the mission. Military leaders will have tremendous pressure placed upon them by the American people to reduce any number of casualties, while each contingency operation, each humanitarian assistance mission, and each peacekeeping operation will be fraught with ever increasing dangers. Exposure to a huge proliferation of an assortment of lethal weapons wait for our soldiers and Marines. Force protection mentioned in both Joint Vision and Marine Corps vision will need to be applied, from forward base security to individual squad and crew security. As it states in JV 2010, "During all operations, advanced technology in the hands of an adversary will increase the importance of force protection at all echelons."^[4]

Survivability or force protection, can be accomplished in many ways and technology will open the door to even more options. Stealth has proven to be a viable survivability option,

unfortunately it allows no real show of commitment or shock effect, provided that is a desired goal.

CONCLUSIONS: FROM THE JOINT VISION AND NMS PERSPECTIVE

From every theme in JV 2010 and the NMS, one sees a requirement to support dominant maneuver, precision engagement, and force protection for purposes of achieving full spectrum dominance worldwide through shaping, responding, and preparing now for the future. Both JV 2010 and the Marine Corps call for being able to fight and win at any level of conflict. The question is, does the tank provide this kind of capability in one package? Is it able to achieve the results needed? One could argue the mobility, lethality, and survivability the tank can provide would support all of the JV 2010 requirements. JV 2010 talks directly to this issue, "Commanders will be able to attack targets successfully with fewer platforms and less ordnance while achieving objectives more rapidly and with reduced risk."^[5] The necessity of using less lethal means to hard target kill is what JV 2010 calls for in the future. A tank seems a logical answer. It provides the non-lethality of shock and presence to the hard target precision kill capability of its main armament. What additional capabilities could the tank possess to make it an even more versatile future combat system? The next few paragraphs will discuss some of the major shortcomings of tank-like vehicles, how to overcome them, and how the future combat system can become more versatile in the future.

The tank has difficulties in the areas of the low observable-masking technologies (LOMT) mentioned in JV 2010. Can a tank possess this capability and retain its shock effect? Shock is primarily the fear caused by the tank's size and/or its indestructible nature in the minds of the adversary on the ground, even in a proliferated world of ATGMs. The tank would need to retain

its highly destructive capabilities at a minimum to retain shock effect. Would a smaller, lighter, Just as mobile, survivable, and lethal tank fulfill the requirement and still retain its shock effect? Logic would dictate that size is only one variable of this multivariate question, the magnitude of importance however, is seemingly unknown.

The NMS and JV 2010 concept of strategic agility is one critical capability the current main battle tank has difficulty supporting. One M1A1 tank per C-17 or C-5 does not offer the airlift option much optimization. On the other hand, with the increasing requirement in the littorals, tank deployment by amphibious ship and/or MPF shipping is a viable and proven option. Air deployability is a larger problem for the Army than the Marine Corps. The U.S. Army Chief of Staff has established a deployment goal for his forces. He desires to be able to move one brigade anywhere in the world, without prepositioning stocks, in 72 hours.^[6] This has driven new requirements on the development of their next generation tank, which the Army calls, Future Combat System (FCS). The goal is to achieve tremendous weight reduction or a vehicle weighing between 15-35 tons.^[7] It is also being asked to accomplish a host of highly specialized tasks on the future battlefield. More on this on the next page. Deployability by air is a problem for many years to come since the FCS is not scheduled for full production until 2015. Amphibious shipping and an MPF mitigate the difficulties in tank deployability for the Marine Corps.

Even though the U.S. Army's FCS Mission Needs Statement (MNS) is a "living" draft document with very dynamic requirements, the Army generally is looking for the FCS to fight at the higher intensity end of the conflict spectrum. The Chief of Staff of the Army has stated when asked about the future of tanks,

"I'm convinced the best killer of a tank is another tank...Can't just kill tanks with precision munitions... we're fortunate to have the best tank in the world. I don't think the tank is a

dinosaur..., and it won't be for the foreseeable future... We must develop a follow-on vehicle and I'm not sure if that will be another tank."^[8]

The FCS possesses some very unique capabilities if ever developed. The Army does expect this vehicle to be a multi-role close combat system. The listing of its unique requirements is provide for reference for discussion in the next section of this chapter.

- * Render enemy electronic equipment inoperative.
- * Defeat materiel targets (bunkers, buildings, etc.) in support of infantry.
- * Defeat aerial systems.
- * Destroy non-line-of-sight targets out to 10km.
- * Transport infantry.
- * Automatic tracking of multiple targets.
- * Have minimum signature in all spectra to reduce detection.
- * Defeat various sensors (munitions, optical, etc.).
- * Detect buried mines.
- * Defeat CE and KE rounds without reliance on heavy armor.
- * 100km/hr dash speed and 70km/hr sustained cross country speed.
- * 50% reduction in Classes III, V, IX required over a 30 day mission.
- * Mobility restoration or maintenance tasks requiring no more than two personnel.^[9]

From looking at the future requirements for the FCS one might conclude that the Army's concept of a multi-role close combat system is more in line with how the Marine Corps views the future. The Marine Corps has always viewed the tank, not as another tank killer, but as a combat support vehicle for the infantry in amphibious and contingency operations, yet retaining the capability to perform at a higher intensity level of conflict as demonstrated in Desert Storm. The next section will discuss these notions in greater detail.

CONCLUSIONS: FROM A MARINE CORPS PERSPECTIVE

It would appear from reading Chapter 4 that the Marine Corps is more concerned about lightening up their forces to be even more deployable (strategically agile) and fit tighter within the contingency operation and urbanized combat "box." A similar view was held during WWII when

the Marine Corps went to a light tank. At the battle of New Georgia it was discovered that combined arms tactics broke down because the light tank lacked the survivability necessary to be offensive and overcome enemy strong-points. From that point on the Marine Corps employed medium tanks with great success. The Corps' historically proven versatility includes the creative ways it uses the equipment it procures. Since it is the military service most constrained fiscally, Marines have been forced to use existing equipment, not ideally suited for certain missions, innovatively and effectively. Colonel Woods, Director of the Marine Corps Warfighting Lab (MCWL) reflects this kind of thinking when he commented that the Marine Corps needs a tank, the challenge lies in our redefinition of its employment based on what we're going to be doing on the future battlefield.^[10] This change and innovation have usually been the product of necessity rather than of institutionalization. The Marine Corps now has institutionalized change with the process called Sea Dragon. The Corps is realizing the number of combat systems it can procure must be reduced. With shrinking budgets, growing national debt, the DoD fiscal picture is looking very bleak. To coin a phrase by one Marine Corps general officer, "the Corps is not short of good ideas only resources to make those ideas reality." The dilemma as outlined in JV 2010 is to combine as many systems to a single platform as feasible and practical. The Corps will probably do one better by using what they do get, better and more effectively than originally conceived.

Let's look at the Corps' emphasis as explained in Chapter 4. First and foremost the Marine Corps still fights and will continue to fight using the MAGTF concept of combined arms. Remember from Chapter 4 the statement, "The beauty of combined arms is that, if planned for and executed properly, it places our adversaries in a position from which they have few good choices. If they attempt to avoid the effects of one of our capabilities, they expose themselves to

exploitation by another." That very nature of combined arms requires the MAGTF to possess multi-faceted capabilities. These capabilities do not have to be lethal means but it could be argued, lethal means will be required more often than not. If the requirement of the MAGTF is to be multi-capable, lethal yet non-lethal, then the more capabilities one platform possesses the better. This holds true from a budget and procurement perspective as well. Additionally, we cannot burden our infantry Marine's load any more than it is already, with a plethora of technology. Even JV 2010 recognizes technology is not always light. A balance must be struck.

The concept of one system doing it all has had its downfall especially in the aviation community... the fighter-bomber that does both missions but neither very well. The aviation example might not be a good reason for discarding a multi-faceted ground weapons platform. The U.S. Army's idea to include the capabilities of transporting infantry, firing direct and indirect fire projectiles, detecting mines, and defeating aerial targets on the FCS is a good one. These missions compliment one another. Unified Combatant Commanders (CINCs) want forces that are versatile, deployable, and effective.

Much of our problem today on the MEU is the space required aboard ship for the varied amounts of support equipment for the wide range of weapons systems embarked, not to mention the square and cubic footage the weapons systems themselves use. A system of systems has tremendous ramifications for savings in many areas; personnel, maintenance, supply, ammunition, etc. Consolidating and eliminating certain military occupational specialties (MOSs), eliminating numerous types of spare parts and equipment unique tool sets, chests, and kits would provide more than marginal savings. Using developing technology, one platform could be used in many roles within the MAGTF from artillery to armored personnel carrier. Things like removable

modular armor, APS systems, electric guns, self-guided munitions, NBC over-pressure, and enhanced night vision devices would revolutionize the Marine Corps MAGTF.

Both JV 2010 and the Marine Corps identify the need to retain the ability to fight in the full spectrum of conflict. What is discussed above would retain that capability. The beauty of having the "right" kind of vehicle is you possess the tremendous capability of having all weather, 24 hour, mobility, lethality, survivability, and versatility.

What about the urban conflict piece of this future warfighting environment? After all, this is a major focus for Marine Corps experimentation, concept and doctrine development. The fighting in an urbanized littoral is projected to be the most frequent possibility. The old style of urban, attrition-warfare siege tactics used by Napoleon or even by the Germans during WWII, has been recognized as impossible in tomorrow's warfare environment for reasons already discussed. The Marine Corps concept paper for Future Military Operations on Urbanized Terrain (MOUT) sums this up by saying:

"Through an understanding of the reasons why MOUT has typically devolved into attrition-style warfare, we can overcome existing limitations so that in the future, Marines will apply *maneuver* warfare to MOUT... Marines must have the technical capability and the operational acumen to identify the enemy's positions of strength and his critical vulnerabilities, *as they exist in the context of a city*. In the attack, instead of grinding their way from house to house, Marines will deftly maneuver through built-up areas, using new and unorthodox mobility techniques to avoid surfaces and exploit gaps. They will bypass and isolate the enemy's centers of resistance, striking killing blows against those enemy units, positions, or facilities upon which his force depends."^[11]

No matter what the concept paper says, fighting in an urban battlefield will be complex and inflict casualties. Look at the number of law enforcement officials killed in the line of duty in U.S. cities over the course of a year. Imagine unlimited, unrestricted warfare in that kind of an environment, additionally characterized by a high degree of weapons proliferation. Without protection through

active and passive means, our Marines will still shed more blood than will be socially, politically, and militarily acceptable.

In response to the concept paper cited above, the Marine Corps has decided to test three types of urban tactics, **urban penetration**, **urban thrust**, and **urban swarm**. Consider for the moment what types of forces and equipment are needed to accomplish the following urban tactics:

"Urban penetration is designed to quickly maneuver to the objective area and establish control in a dispersed and non-contiguous battlefield. It requires sufficient mobility to move quickly to the objective area, seize the objective, and isolate and protect it from the enemy and non-combatants...Movement to the objective area can be either surface, subsurface, or above the surface. The unit must possess sufficient firepower and protection to arrive at the objective area in sufficient force to seize the objective and establish control. Stealth will often be the preferred movement tactic in order to maximize force protection and surprise.

Urban Thrust envisions a narrow assault against the enemy. The thrust maximizes combat power at the point of the attack. It can be conducted on multiple axis simultaneously... The intent of the concept is to avoid the linear assault, while confusing the enemy, forcing his flanks, isolating his forces, and in general deceiving him as to our true intent, and hopefully, forcing his withdrawal and exposure without the necessity of a room-by-room clearing of the city.

Urban swarm is a tactic similar to the tactics used by the police in responding to an emergency which requires back-up. Swarm envisions numerous small teams operating in a dispersed non-contiguous fashion. As these teams patrol they may be required to back-up other teams or require back-up themselves."^[12]

Tasks such as isolate, back-up, disperse, protect, have sufficient mobility, and sufficient firepower were all listed in the three urban tactical concepts. These tasks must be performed well, in an extremely casualty prone environment, for the concepts to work. Infantry or team protection is paramount in this environment which will be littered with falling concrete and glass and include weapons fire of all sorts. If complicated by chemical or biological agent then we have burdened our infantryman with an additional protection problem. How much can we ask of the individual Marine in terms of wearing NBC protective clothing and body armor of some sort;

carry sufficient communications equipment required for dispersed tactics; and still carry the necessary firepower or designation system to affect the enemy? Granted, taking a multi-faceted future combat system into sewers or subways might be difficult but is it realistic to expect our infantry to enter the urban environment devoid of such equipment? It seems more logical to ensure the development of such a system fits within the urban constraints, width, height, weight, suspension system, and the necessary "measured firepower" required in cities. After all, what kinds of supporting arms will these tactics require and how will they be employed? If precision guided munitions can be delivered to indirect-fire targets from a multi-faceted future combat system, what would be the requirement for close air support, mortars, or even artillery? One answer: potentially none to fewer systems than currently fielded...another factor justifying an adjustment to force structure by size and composition.

The urban warfare concept papers all admit that the urban fight is exhausting and stressful to the individual Marine as well as to commanders. The urban fight will confound Marines and their commanders through the exhaustion of resources, creation of collateral damage, and the long duration of the fight. A popular answer to this dilemma is, we must train and educate our Marines and their commanders to be even better than they are today. No doubt training and education is paramount but how adequate can you train and educate a Marine and his commander to cope with continual doses of combat stress, fatigue, and nonstop, long duration, decision making? The proper conclusion is, that individual Marine and commander must from time to time rest and feel some sense of safety. A popular counterpoint to the safety and survivability issue is the requirement for stealth. Unfortunately, stealth does not provide that same level or sense of safety more active protective measures provide in the highly dangerous urban environment for which we intend on sending our Marines.

The hallmark of our tactical doctrine is centered around maneuver warfare, which is based on tempo. Without sustained peak performance from our Marines and their commanders, Marine units will fail to achieve this tempo. Without this tempo our tactical doctrine based on maneuver warfare breaks down. Realizing basic, individual human vulnerabilities in future environments are key to developing combat system equipment requirements. It is reasonable to conclude that a system offering survivable protection is critical for success in the urban environment.

The numbers of contingency operations will undoubtedly increase as has been projected by the JSR. The Marine Corps already has been faced with several types of operations from peacekeeping to military operations other than war. As we have discovered today and as in tomorrow's fight our Marines must expose themselves to increased danger under constraints of very strict rules of engagement (ROE). It is much more realistic to assume a Marine will be able to apply restrictive ROE better when he is placed in a position or environment whereby he can absorb the first shot. After all, one Marine firing on the wrong target, at the wrong time, in the wrong location will have operational significance if not strategic significance. Presence with survivability is difficult to achieve without a survivable platform from which to operate.

The Marine Corps concept of OMFTS/STOM is one that hinges on the capability to deploy from the ships to the objective over the horizon via MV22, AAV, or LCAC. If one truly believes in a multi-faceted future combat system then unless it can swim it can only find its way to shore via the MV22 (external) or the LCAC. Even with our current CH53E, the Marine Corps light armored vehicle (LAV) with full combat load exceeds the limits of the helicopter's external lift capability. The only options remaining are, swim or LCAC. Either are good options and will become increasingly more viable as technology develops.

If the Marine Corps feels it does not require a mult-faceted future combat system (tank), rather derive this kind of support from the Army, it might find itself coming up "empty handed." The most recent example of Army tank support to Marine forces was the support given during the Gulf War in the form of the Army's "Tiger Brigade." One must recognize the mission given the Marine Corps was a traditional Army land war mission. In other words, the Tiger Brigade functioned in an environment the Army typically trained for during the Cold War. Will the Marine Corps continue to be so lucky, in terms of its missions? Given the future strategic environment, the Marine Corps missions will most likely be dissimilar to Army missions. Besides, Marine Corps combined arms tactics and fire support doctrine differ substantially from Army practices. Without its own organic future combat system, the Corps cannot be guaranteed support unique to its missions. In an interview with the Chief of Army Armor, Major General G.H. Harmeyer when asked if the Army could assume armor missions for the Marine Corps he stated:

"I am of the opinion that the force needs its own organic mobile, armor protection and firepower for the unique missions that you're still tagged with. If somewhere in the national scene up in the Joint Staff or elsewhere where they were to meld the Army and Marine Corps missions together and we all became the same then that would be entirely a different situation. I think there is significant distinction between Marine Corps capabilities and mission to still retain a separate service. We need to be complimentary."^[13]

In addition, the U.S. Army and Marine Corps signed a memorandum of agreement (MOA) on 24 October 1994 stating:

"The Secretary of Defense in his memorandum, subject: Role, Missions, and Functions of the Armed Forces of the United States, dated 15 April 1993, directed the Secretary of the Army, assisted by the Secretary of the Navy, to "establish Joint procedures to provide additional armor support to the Marine Corps when required. The Marine Corps will retain sufficient tank assets to support amphibious operations and outfit maritime prepositioning squadrons." ...There are no major doctrinal changes required to permit effective integration of an Army Armor unit in support of Marine Corps operations."^[14]

It seems quite evident the U.S. Army is not prepared nor does it desire to exercise in an amphibious way. Even though they are looking at urban conflict, the way they have postured themselves in Force XXI, their doctrine, tactics, and techniques in that environment, will probably be quite different than those of the Marine Corps. Their units will not be prepared to work in those specific environments within a MAGTF organization. The Army Armor Officer Advance Course at Ft. Knox, KY once taught a one week block of instruction on Marine MAGTF operations. Now the segment is optional to each individual instructor. Currently the general trend is not to teach the MAGTF block.^[15]

RECOMMENDATIONS

Based on the various conclusions above, it would seem prudent for the U.S. Marine Corps to embrace a similar approach to the Army's research and development (R&D) of their future combat system. There seems to be sufficient requirements for a Marine Corps unique future combat system.

The Marine Corps has several options. It could "turn-up the heat" on the Army R&D and requirements efforts of the FCS by attempting to "steer" the program more toward unique Marine Corps requirements. Attacking the R&D efforts in this manner runs the risk of countless confrontations and compromises with the Army, resulting in a system fulfilling mostly Army requirements and few Marine Corps requirements. Another potential problem is traditionally Army armor programs result in vehicles nearer the heavier end of the weight specification limit.

The Marine Corps cannot afford a 35 ton vehicle even though the NDP recommended the following:

"Develop the twenty-first century tank to be a unique vehicle relying on speed, agility, and hyper-velocity gun technology for operational effectiveness (the Panel's view is that 30-35 tons is the appropriate weight range)."^[16]

The 35 ton tank might be perfect for the Army but not for the Marine Corps of the future.

The Marine Corps forte of being a force in readiness requires it to possess the strategic agility to deploy anywhere at anytime. A heavy combat system will not adequately fulfill this requirement. Additionally, the Marine Corps must be able to use this multi-faceted FCS for small contingency operations as well as MOOTW and a variety of peacekeeping efforts within the full spectrum of environments. This system must traverse and be able to perform in poor infrastructure in undeveloped countries to complex urban environments with elaborate underground systems and elevated road networks. Normally associated with weight is the accompaniment of greater support infrastructure, i.e., fuel and maintenance. Weight will only serve as a friendly critical vulnerability.

The Marine Corps might look more closely at the Army's future scout vehicle program which might better suit Marine Corps requirements. By leveraging technology from this program (i.e., removable armor packages, troop space, etc.) and combining it with technology acquired from the Army's FCS, the Marine Corps can achieve the best of both programs and save money by leveraging Army research, development, test, and evaluation.

An additional option could be to incorporate the multi-faceted future combat system with the AAV program by adding the appropriate requirements. In fact, by combining the technology leverage mentioned above with the existing USMC AAV program, the Marine Corps would be better served in the long term. It is understood, any redirection in the AAV

program would further delay the fielding of a STOM oriented vehicle but it is commonly known the Marine Corps typically keeps its equipment well beyond its service life. One could argue, it is better to begin the development of a leap-ahead capability now, than invest what little the Marine Corps does have in a vehicle "overly specialized." As it stands currently, the AAV program is excessively costly. Combine that fact with the potential of cost over-runs and the Marine Corps could find itself in a grave fiscal situation. World market popularity might result by the development of a swimming, multi-faceted, future combat system, which might ultimately drive down procurement costs for the Marine Corps. Combine these cost savings with any efficiencies realized by combining programs, consolidating units, and combining roles, missions, and force structure...all resulting from the development of a versatile, multi-faceted, multi-variant, future combat system...a prudent solution in a fiscally constrained environment.

Ideally, the Marine Corps' multi-faceted future combat system would swim both to save LCAC lift (thus mitigate Marine Corps reliability on Navy funding priorities) and aid with self sustainability from sea based logistics platforms. The LAV seems to be a good model to follow, in terms of having several variants with the same chassis and engine. The LAV model even demonstrates several of the requirements for a multi-faceted future combat system, i.e., lethal armament, infantry spaces, air defense, and indirect fire capability. Using this LAV variant concept, even a swimming, logistics variant of the future combat system could be included in the development.

The current LAV is getting older and has already undergone several modernization upgrades (engine, thermal sights, etc.). It could be envisioned that the multi-faceted future combat system could replace the existing M1A1 main battle tank, the LAV, and the AAV/AAV. The Marine Corps cannot afford to continually upgrade its M1A1 tank while developing on its

own, both the AAV and whatever new version of the LAV currently envisioned. The concept of leveraging the technology R&D that the Army will be investing toward their FCS and future scout vehicle seems the most logical answer. Project managers and acquisition assets could be combined to make this effort happen. Their efforts must be guided by the Marine Corps vision of tasks required to be performed on the future battlefield.

The Marine Corps must make a commitment toward revolutionary change in its look at equipment development just as it has with concepts/doctrine development. Both must be done concurrently using the combat development process to be able to proceed down the road to the future. In the words of the NDP, "All forces must shift funds from upgrade of legacy systems to new systems focused on meeting the challenges of 2010-2020."^[17] We must maintain our current older systems until we can "leap-ahead." We have been innovative in the past doing this and we can continue to be creative and prudent while we wait for this revolution to occur. We must not feel the AAV/AAV, the LAV, or the M1A1 is the ultimate answer. All of these collectively and none of these individually are the answer as it has already been explained. Figure 7 compares only one capability between these vehicles, probably the most important for future warfare, that of survivability. Important fact to note is the vast differences in capability.

	LAV	AAV	M1A1
Rifle	P	P	P
7.62 Mach Gun	V	P	P
12.7 Mach Gun	K	K	P
30 MM	K	K	P
76 MM	K	K	P
AT-4	K	K	P
AT-5	K	K	P
125 MM APFSDS	K	K	V

K = Kill V = Vulnerable P = Protected

Figure 7. Survivability versus Threat Systems

Source: Janes Information Group

On the other hand, the Marine Corps should not get impatient either. As technology matures and our doctrine is rethought and rewritten, we must retain these three weapons platforms and the force structure supporting them until we are capable of leaping ahead. During this interim period the Marine Corps must flesh-out the force structure it would require assuming multi-faceted vehicle fielding.

The Marine Corps has always taken to the fight what was necessary to win. This should not change during this interim period. If the situation warrants the need for the tank, deploy it, if the LAV is a better solution for a particular mission then deploy it, leaving the tank back. If the LAV, AAV, or tank communities need to modify doctrine, equipment logistics SOPs, deployment techniques, etc. to support the Marine Corps' revolutionary move to the future while waiting for the Marine multi-faceted future combat system, then adjustments should be made and quickly. MEU commanders and all other MAGTF commanders will continue to do mission area analyses to determine what weapons and systems will accomplish their mission, weigh those considerations with deployability capability, then make the best decision given what they have available in their operational and tactical "tool bag."

The Corps must not however, get impatient for technology and reduce our capabilities prematurely. It must work through each existing vehicle's problems the best way it can and at low cost until this Revolution in Military Affairs is realized. The following quote from *Concept for Future Joint Operations, Expanding JV 2010* seems appropriate:

"Sometimes, as in the transformation of the French Army in the 1790's or Mao Tse-tung's development of the "people's war," an RMA may not involve the use of advanced technology but only new concepts. In this context, the term *revolution* does not mean *rapid* change--past revolutions have unfolded over a period of decades; rather it means that change is profound and the new concepts and methods of warfare are far more powerful than the old."^[18]

Our revolution may also take decades but the one critical element we must understand is, the profoundness of change must make our concepts and methods of warfare and national defense more powerful than the old. Times are changing faster than the "bureaucracy" will allow. Patience and perseverance will allow the Marine Corps and all U.S. military forces to successfully accomplish this transformation into the 21st century.

NOTES

[1] Dragon Fire, an unattended mortar system, is currently being tested by the Marine Corps Warfighting Lab in Quantico, VA.

[2] Kagan, Donald, Dr., "Are U.S. Forces Overstretched? Roles and Missions," Orbis, Spring 1997, p. 195.

[3] Concept for Future Joint Operations, Expanding Joint Vision 2010 (Fort Monroe: Commander, Joint Warfighting Center, 1997), p. 22.

[4] Joint Vision 2010 (Washington D.C.: Chairman of the Joint Chiefs of Staff 1997), p. 14.

[5] Joint Vision 2010 p.13.

[6] Interview between General Reimer, Army Chief of Staff and John Barry, Newsweek, 6 Oct. 1997.

[7] Personal interview with Mr. Alan Winkenhofer, Assistant Head of Science & Technology Directorate, U.S. Army Armor Center, 21 October 1997.

[8] Interview between General Reimer and John Barry.

[9] Personal interview with Mr. Alan Winkenhofer.

[10] Personal interview with Colonel Tony Woods, Director of the Marine Corps Warfighting Laboratory, 23 Oct. 1997.

[11] A Concept for Future Military Operations on Urbanized Terrain (Quantico: Marine Corps Combat Development Command, 1997), pp. 4-5.

[12] Draft Conceptual Tactics for the Urban Environment. Annex A to Urban Warrior LOE 1 Experimental Plan (Quantico: Marine Corps Warfighting Center, undated), pp. 1-4.

[13] Personal interview with Major General G. H. Harmeyer, Chief of Armor, U.S. Army Armor Center, 21 Oct. 1997.

[14] "Memorandum of Agreement between the U.S. Army and the U.S. Marine Corps" (Washington D.C.: 1994), para3 and 5a.

[15] Personal interview with Lieutenant Colonel Jeffrey Wilkinson, USMC Liaison Officer, U.S. Army Armor Center, Ft. Knox, 22 October 1997.

[16] Transforming Defense, National Security in the 21st Century (Arlington: Report of the National Defense Panel, 1997), p. 47.

[17] Transforming Defense. National Security in the 21st Century p. 46.

[18] Concept for Future Joint Operations. Expanding Joint Vision 2010. p. 24.

BIBLIOGRAPHY

- Barry, John (Newsweek) and General Reimer, U.S. Army Chief of Staff Interview between, 6 Oct. 1997.
- Beyoghlou, Kamal A. Dr., "Religious Extremism and Terrorism: Threat and Response," lecture, Marine Corps War College, Quantico, 1 Dec. 1997.
- Binnendijk, Hans A. and Patrick L. Clawson, eds. 1997 Strategic Assessment, Flashpoints and Force Structure. Washington, DC. Institute for National Strategic Studies, National Defense University, November, 1996.
- Campbell, Michael, Major USMC, Commanding Officer, 1st Tank Battalion (Fwd), MARFORSOM, CJTF Somalia, personal interview, 22 Oct. 1997.
- Clausewitz, Carl von. On War. New York: Knopf Inc. 1993.
- "Commandant's Planning Guidance, Frag Order," Washington D.C., Office of the Commandant of the U.S. Marine Corps, 1997.
- Concept for Future Joint Operations. Expanding Joint Vision 2010. Fort Monroe, VA., Commander, Joint Warfighting Center, 1997.
- Concept for Future Military Operations on Urbanized Terrain, Quantico, VA., Marine Corps Combat Development Command, 1997.
- Draft Conceptual Tactics for the Urban Environment Annex A to Urban Warrior LOE 1 Experimental Plan, Quantico, VA., undated.
- Exploring Hunter Warrior. Quantico, VA., Marine Corps Warfighting Laboratory, 1997.
- Gangle, R. A., Colonel USMC (Ret.), Senior Operational Advisor, Marine Corps Warfighting Laboratory, Quantico, VA., Personal interview, 23 Oct. 1997.
- Gregson, W. C., Brigadier General USMC, "Preparing for the Day after Tomorrow," Briefing to the Marine Corps War College, Arlington, VA., 16 Dec. 1997.
- Hammett, Thomas, Intelligence Analyst, "The Proliferation Threat," U.S. Army Armor Center, Fort Knox, KY., undated.
- Harmeyer, G. H., Major General USA, Chief of Armor, U.S. Army Armor Center, Fort Knox, KY., Personal interview, 21 Oct. 1997.

Headquarters, U.S. Marine Corps, Plans, Policies, and Operations Department, "U.S. Marine Corps, Initiatives and Innovations in an Uncertain World," Briefing to Ms. Flournoy, DASD(S), date unspecified.

Herbert, Paul, Colonel USA, "Joint Strategic Review," Briefing to the Marine Corps War College, Quantico, VA., 2 Oct. 1997.

Joint Vision 2010. Washington D. C., Office of the Chairman, Joint Chiefs of Staff, 1997.

Kagan, Donald, Dr., "Are U.S. Forces Overstretched? Roles and Missions," Orbis, Spring 1997, pp. 187-198.

Maritime Prepositioning Force 2010 and Beyond, Concept paper, Quantico, VA., Marine Corps Combat Development Command, undated.

"Memorandum of Agreement between the U.S. Army and the U.S. Marine Corps," Washington D. C., 1994.

National Military Strategy, Washington D. C., Office of the Chairman, Joint Chiefs of Staff, 1997.

Operational Maneuver from the Sea, Pamphlet, Quantico, VA., Marine Corps Combat Development Command, 1996.

Phipps, David M., Senior Intelligence Analyst, "Armor Intelligence/Threat Briefing," Fort Knox, KY., U.S. Army Armor Center, 21 Oct. 1997.

Reimer, Keith, Major USMC, Planner IFOR, Personal interview, 1 May 1997.

Report of the Quadrennial Defense Review, Washington D. C., Office of the Secretary of Defense, 1997.

Shaw Jr., Henry I., Tarawa, a legend is born. New York, Ballantine Books Inc., 1968.

Steele, M. R., Lieutenant General USMC, "A Corps of Marines for the 21st Century...Plotting the Transformation for the Nation's Force-in-Readiness," Briefing to the National Defense Panel, Arlington, VA., 8 Aug. 1997.

Taylor, Joseph M., Captain USA, "U.S. Army Armor Center's Survivability Perspective," Briefing, Fort Knox, KY., 21 Oct. 1997.

Transforming Defense. National Security in the 21st Century. Arlington, VA., Report of the National Defense Panel, 1997.

U.S. Marine Corps Concepts and Issues, 1997, Washington D. C., Programs and Resources Department, Headquarters, U.S. Marine Corps, 1997.

U.S. Marine Corps Concepts and Issues. 1998. Chapter 4 Draft, Washington D. C., Programs and Resources Department, Headquarters, U.S. Marine Corps, 1997.

U.S. Marine Corps Master Plan for the 21st Century, Washington D. C., Plans, Policies, and Operations Department, Headquarters, U.S. Marine Corps, undated.

Wilkinson, Jeffrey, Lieutenant Colonel USMC, USMC Liaison Officer, U.S. Army Armor Center, Fort Knox, KY., Personal interview, 22 Oct. 1997.

Winkenhof, Alan, Assistant Head of Science and Technology Directorate, U.S. Army Armor Center, Fort Knox, KY., Personal interview, 21 Oct. 1997.

Woods, Tony, Colonel USMC, Director of the Marine Corps Warfighting Laboratory, Quantico, VA., Personal interview, 23 Oct. 1997.